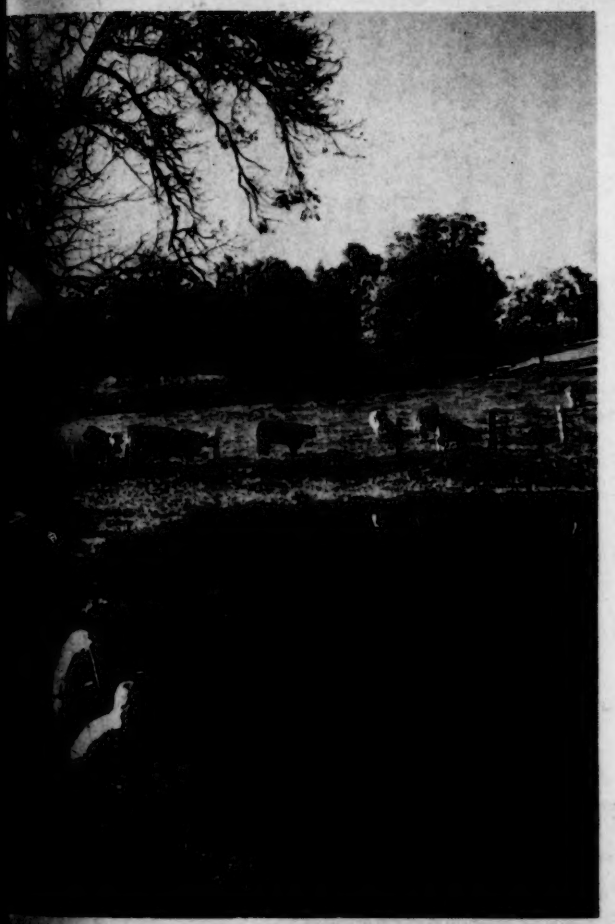

Vol. 8, No. 2 **March, 1953**

Continuous Plant Cover — The Key to Soil and Water Conservation
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. . . RAYMOND W. MILLER

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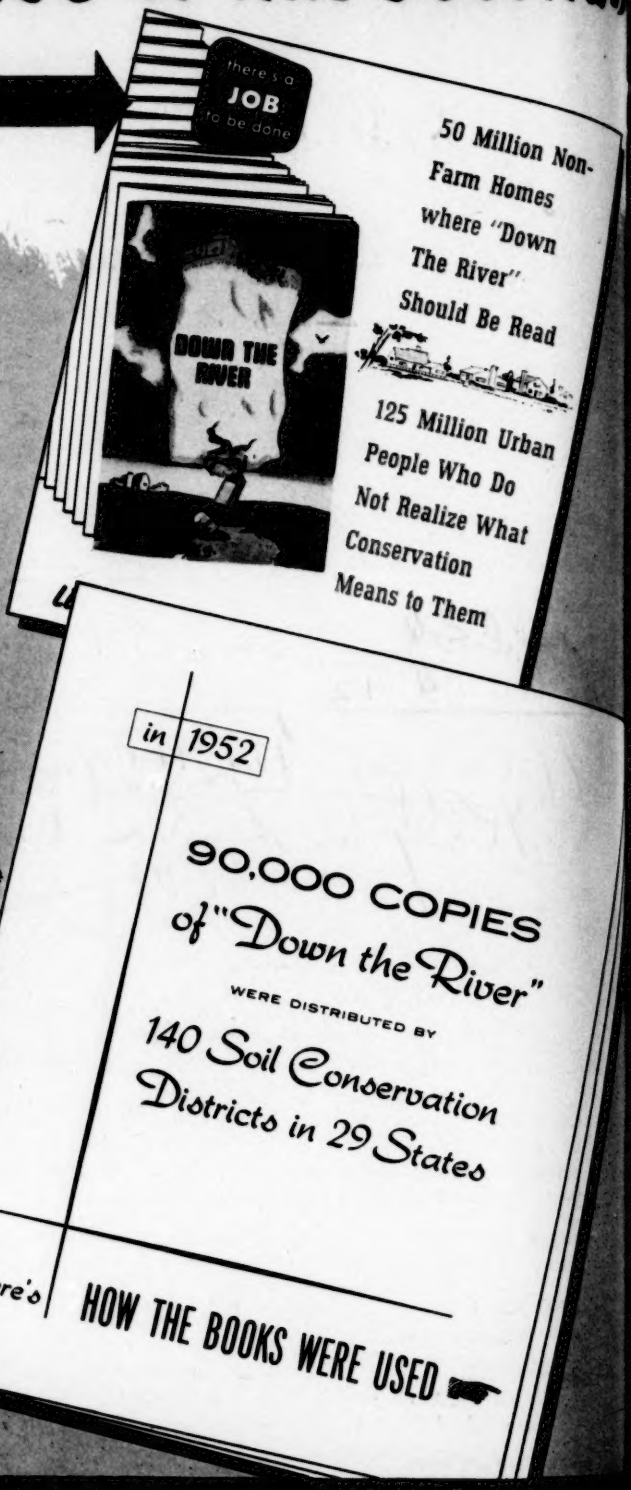
. . . STANLEY A. CAIN

Educational Aspects of the Soil and Water Conservation Movement in the United States
. . . F. W. Fox

Book Reviews: Understanding Iowa Soils, Resource Conservation: Economics and Policies, The Grass Crop — Its Development, Use and Maintenance; also others

In the April, 1952 Issue of this Journal

WE SAID: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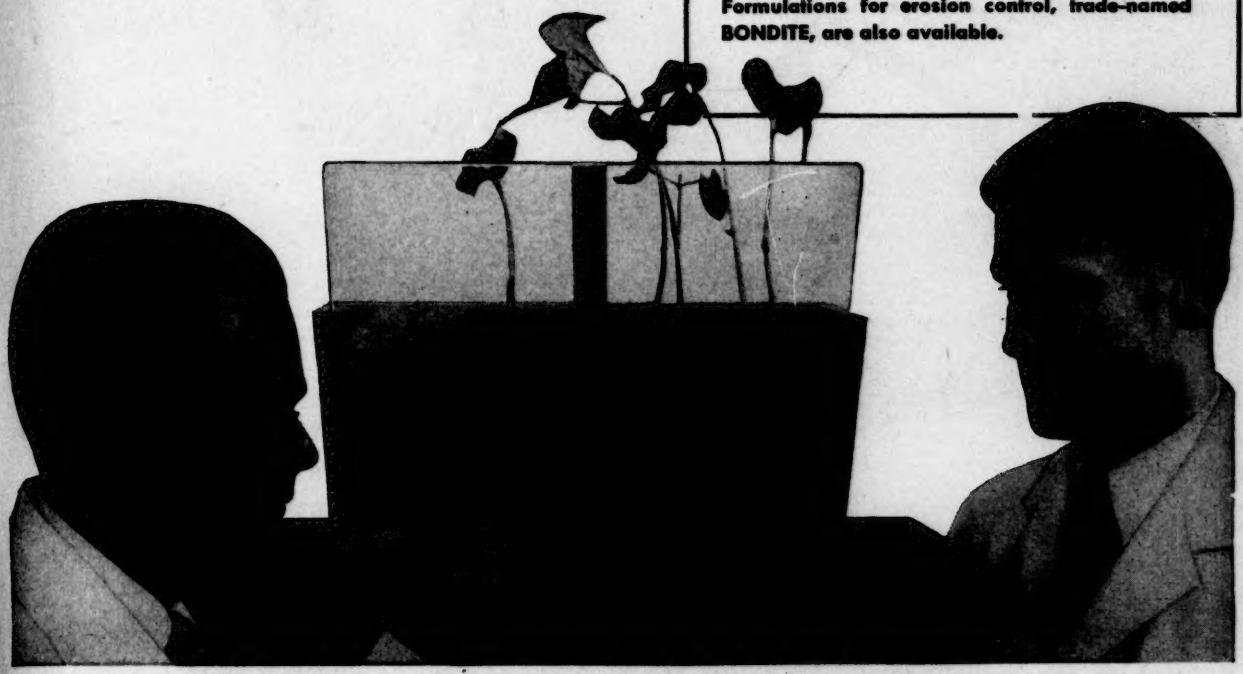

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Journal of SOIL AND WATER CONSERVATION

VOLUME 8
NUMBER 2

TO ADVANCE THE SCIENCE AND ART OF GOOD LAND USE

This JOURNAL is the official organ of the Soil Conservation Society of America. It is owned, edited, and published bi-monthly by the Society.

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Contents for March, 1953

Excerpts from Educational Aspects of the Soil and Water Conservation Movement in the United States
F. W. FOX 59

Continuous Plant Cover—The Key to Soil and Water Conservation
J. H. STALLINGS 63

Worldwide Technical Cooperation
RAYMOND W. MILLER 69

Conservation Comes of Age in Michigan
WILLIAM B. HALL 70

Torrent and Avalanche Control 74

Pictorial Section 75

Some Aids in Evaluating Sheet Erosion in the Northeast
ARNOLD J. BAUR AND HENRY R. ADAMS 79

Some Notes on Early Conservation Practices
E. D. KNIGHT 82

The Higgins Lake Conservation Conference
STANLEY A. CAIN 85

Boy Scouts Apply Conservation Plan on Own Camp Area
JAMES E. MCDONALD 87

Book Reviews 90

Field Notes and Comments 95

The Cover

This very excellent by-pass farm pond emphasizes water for stock, fishing, irrigation and recreation. It is on the Earl Truax farm near Warfordsburg, Penna.

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Dirt Bucket (above) and Dozer Blade (below). Two of the quickly interchangeable attachments for the New Idea-Horn hydraulic loader.

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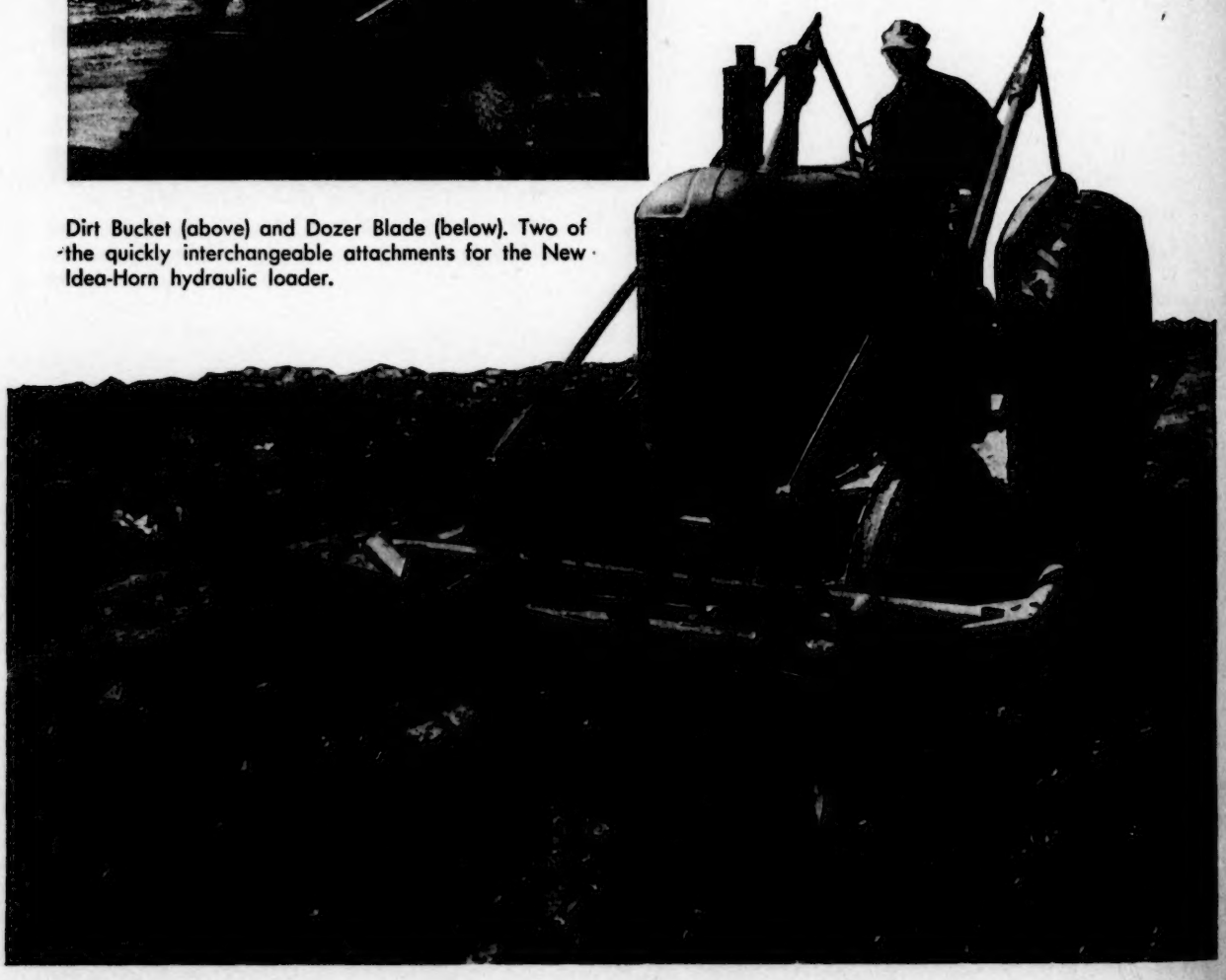

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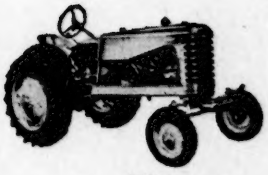

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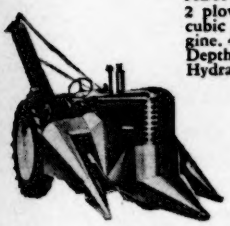

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The field in which these men are standing looked like the slope across the valley just a few years ago. It was eroded, barren and low in fertility. Now it has been reclaimed for productive agriculture.

Hundreds of thousands of acres can be saved in the same way *if conservation measures are started before it is too late.* Allis-Chalmers has continuously cooperated with farmers, local Soil Conservation Districts, farm equipment dealers and community leaders in adapting home-owned farm equipment for this important work. Larger equipment such as the Allis-Chalmers Model D Motor Grader is recommended where it can be used to advantage.

There is no need to wait. By utilizing the more than 100 million tractor hp. now on farms, practical soil conservation can be put into effect on *every* farm without delay.

The Model D Motor Grader has tandem drive and other big-grader features, yet weighs much less and costs only about one-third as much. It's practical for use on farms — can cross ordinary farm bridges, drive through farm lanes and gates, does a good job on terracing and similar work.

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Excerpts from

Educational Aspects of the Soil and Water Conservation Movement in the United States

F. W. FOX

Dr. F. W. Fox spent three months in the summer of 1951 studying soil conservation in the Southeastern, Upper Mississippi Valley, and Southwestern Gulf States, studying especially educational phases of the soil conservation program. He is a staff member of the South African Institute for Medical Research in Johannesburg, Union of South Africa. Dr. Fox has worked for many years in programs affecting the health and nutrition of the South African rural population. When the Union's Soil Conservation Act was passed in 1946, Dr. Fox was appointed to the Soil Conservation Board as one of five members representing the public. He is now entered on another three-year term as member of this Board; also Chairman of a subcommittee concerned with educational phases of the Soil Conservation Board's responsibilities. It was in the interest of this subcommittee that he made the trip to the United States on a special grant provided by the Carnegie Corporation of London. Many district supervisors and farmers, as well as professional workers, had the opportunity of becoming acquainted with Dr. Fox during his visit to the States. Effort has been made to extract some of the more significant statements in Dr. Fox's report. The entire report is worthy of study because of his keen analytical appraisal of the educational features of the soil conservation program in this country.—W. R. Tascher, Extension Soil Conservationist, U. S. Department of Agriculture.

I HAVE RECENTLY returned from a visit to the United States made for the purpose of studying the educational aspects of the program which is being conducted there to conserve their soil and water resources.

The aspects which I particularly wanted to study were:

(1) How the more far-sighted American farmers and others *educated themselves* to an awareness of what was happening to their natural resources—in other words the history of the movement;

(2) How the American people set about tackling the problem (a) *of educating the farmers and others more directly connected with the land;* and (b) of *changing the outlook of the rising generation,* so that the mistakes of the past will not be repeated in the future;

(3) How the movement is progressing and what are the main obstacles encountered.

It has been my hope that a study of this nature, made in a country where the pioneer work in conservation education has been done, might assist us in dealing with our own problems in South Africa.

While it is true that there are many problems which are common to the two countries, there are also many differences: hence we must visit another country *in order to study rather than to imitate.*

What Do We Mean By Soil Conservation?

It is sometimes argued in America that too much emphasis is placed upon conservation farming and that in fact there is no such thing: only good farming. This is of course true, academically speaking; in fact, if we only knew what "good" farming was, it would be the only thing to aim at, and would probably include many practices which are now accepted as desirable and satisfactory. But as knowledge grows and a better insight is attained into what "good" farming means, it becomes necessary from time to time to emphasize certain aspects—at least until they are widely accepted and practiced. No doubt in the 18th and 19th centuries in America there were many "good" farmers, according to their lights, but this did not prevent them from ruining their land.

The task and object of conservation education is nothing less than to change the "philosophy" of the whole community towards its biological foundations. As Hatcher wrote in 1951:

"Conservation education may be viewed as the sum of all learning experiences which facilitate the development and understanding of an appreciation for the nature and complexity of the natural environment; a recognition of the dependency of human welfare upon life in harmony with the earth; a sensitivity to resource misuse; a desirable combination of favorable attitudes relative to wise use of the earth, and a feeling of individual social responsibil-

ity for its continued productivenes and ultimate well-being."

Although this report is to deal with the educational aspects of the soil conservation movement in America, I have not hesitated to describe elsewhere in some detail the manner in which soil conservation districts are organized to carry out their job, because the whole process is one that teems with educational opportunities and possibilities. At each stage in the formation and activity of a district, educational factors are at work, though it should be added that the district committee does quite often undertake work that may be regarded as more specifically of an educational nature; thus it may arrange publicity through the press, circular letters to cooperators, county and community meetings, demonstrations, tours, field meetings, and even schools for the training of leaders. Unless the district can carry the cooperators with it, progress is bound to suffer, whilst when good work is done, it is bound to make some impression on those who live nearby and can see for themselves what is happening.

It is perhaps hardly necessary to refer to the important educational effect that the farm plan can have upon the farmer; all too often he is found to be carrying on from year to year with only a very partial knowledge of the characteristics and potentialities of his farm; he has become set in his outlook and habits and has not thought, perhaps, of his farm *as a whole*. It often takes the trained eye to discover or assess the changes and deterioration that are taking place, though when once pointed out he finds they explain many things of which he was previously only vaguely conscious. Better still, the feeling that he is engaging on a well-thought out plan for the future, based on experience with similar conditions elsewhere, yet definitely designed for his own acres, fills him with a more solid hope and can renew ambitions that may have grown cold through past failures.

Although strictly a technical matter there is one most important outcome of this practical research work to which we would like to refer, namely, the remarkable progress that has been made during the last few years in the use of grasses and legumes. The development of grassland farming *"amounts almost to a revolution in American agriculture."* Not only have such practices proved of the utmost value in the control of erosion, but, according to Dr. Hugh H. Bennett "Grass is proving itself an economic crop comparable to row crops on even our best lands, while it exceeds the economic production of row crops on lands less suitable to the production of these and small grain crops." Hundreds of thousands of farmers who never planted a grass or legume crop until a few years ago, are now planting a major part of their farms to these sod crops. Ranchers who never thought of planting grass before, are planting thousands of acres to native or introduced grasses, or both.

Highly important—indeed spectacular—as these developments have been (and on many occasions I was taken to see for myself what they meant to enthusiastic individual farmers), I could not but fail to be impressed by this clear-cut proof of what the right type of research can do to educate receptive minds. It was indeed a startling and unanswerable proof of the value of conservation education as conceived and carried right through to the man on the land by a live and determined conservation service.

Another most interesting discovery regarding the technique of educating the farmer or rancher is that usually described as the "neighbour group approach." In the early days of the Soil Conservation Service it was more or less assumed that all that was necessary was to carry out some striking demonstrations of the benefits of conservation farming; and people would see, be converted and go away to do likewise. As we have seen, this method of approach did yield results that were fairly satisfactory, but they were not nearly so effective as had been hoped, or rather assumed. For a time the only solution appeared to be to continue patiently, hoping that as time went on progress by imitation would become faster.

One of the main discoveries that has emerged from this study has been that, instead of attempting to create an artificial group of people, linked together merely by their common interest in soil conservation—or, if you prefer the term, "good farming"—it is much better to spend time and effort during the initial approach in an area where a district organization seems to be needed, trying to study and map out the various groupings which the population, over the course of time, have created for themselves.

Conservation Education in the Schools and Colleges

The pioneer conservationists didn't take very long to discover that if they were to succeed in changing the attitude of the general public—urban as well as rural—towards the wise use of natural resources it would be essential to include some work with the children. Not only did experience teach that some adults were too conservative and set in their ways ever to make effective conservationists, but it was also clearly recognized that it would be futile merely to reverse the destructive processes that were being practiced by one generation only to begin all over again with the next. Nothing short of a different outlook which embodies a real understanding of the relationship between our natural resources and

our way of living will suffice; and this must be taught to the children in an interesting but convincing manner, as and when they can appreciate it, but probably right through the school years.

Thus I found that although the ideal of "integration" was often accepted it was more usual in practice to include conservation teaching in those subjects which are more nearly related, such as "nature study," geography, biology and, to a lesser extent, history. It would seem that this must remain the solution for the time being, at least for the smaller children, for, as the Chairman of the National Committee on Policies in Conservation Education puts it:

"Conservation education should be based on experiences that deal with local realities which the learner can easily understand, such as forests, animals, soils and streams. These experiences should recognize the relationship of cause and effect and link individual behaviour with social responsibility."

When discussing the subject of textbooks with teachers who are actually on the job I found that they are still not satisfied with the material available at the more advanced levels. For more elementary teaching the view was commonly expressed that they did not favor "a" textbook, however good, but preferred a collection of small books and booklets that were well illustrated and that dealt with some particular aspect. A small library of this kind could easily be built up and could then be drawn upon at will, both by the teacher and the child.

In Alabama, not far from Birmingham, I met the superintendent of schools, together with several of his teachers. The general impression gained here was much the same as in Wisconsin. Little difficulty was experienced in gaining an excellent response from the children. Their fresh and eager minds rapidly assimilated ideas which are so closely related to the world they live in and the scenes that they pass on their way to and from the school. Here the children had made a study of the small town in which they lived to find out to what extent it was self supporting as far as food and other needs are concerned, and how far these items had to be imported, and where they came from. This gave the geography lesson a new slant. Once again the high desirability of taking teachers and children to see and study conservation problems at first hand was stressed; they use busses for this purpose, though some parents come forward with lifts in their own cars.

During my visit I was able to meet a number of bankers and learn from them at first hand regarding their attitude to such matters. On several occasions we were taken to see farmers whom they were helping. A particularly interesting case was where one bank had turned the man's request for credit down and the other, after careful investigation, was fully convinced that if he cooperated with the local soil conservation district the loan was justified. It was pointed out that modern farming requires far more capital than it did in former days, so that the wide-awake banker is changing his ideas on credit levels. Again, where the farm is too small to be run as an economic unit the banker can be of great assistance by helping to purchase the necessary additional land. I collected samples of the regular bulletins that are sometimes circulated—such as the "Soil Saver" in Virginia. In yet another area I found that the bank had enabled some veterans to start off as private contractors for doing soil conservation work by financing the purchase of the necessary machinery.

Public Reaction to Conservation Program

I found a certain amount of difference of opinion amongst conservationists as to whether they should be content to begin with interesting a farmer on the adoption of some single practice that would assist him to conserve his land, or to wait until he was prepared to go much further and accept a complete farm plan. There are obvious advantages in both lines of approach, whilst much depends upon the nature of the district and the state of the farm itself. Naturally it is much easier to adopt the former method and hence, at least on paper, a year's work on the part of the service will be likely to show more results. Farmers, too, differ greatly in the way they look at these matters. A cautious man may have reached the stage when he is willing to make a small beginning, which may be of considerable value, yet he may be far from willing to adopt a more comprehensive scheme. Another type may be slowly reaching a stage when he is mentally ready for big changes and may actually prefer to do the thing properly while he is about it. One cannot help having a good deal of sympathy for the farmer who has perhaps known every inch of his farm both in his own time as a farmer and in the days when it was run by his father—or even grandfather. To make wholesale changes may be most difficult to such a man, even though he accepts the need for them.

These illustrations of the way the public react to the conservation campaign have one thing in common, namely that they indicate the central importance of the educational side of the work. If conservation farming is as desirable, indeed as essential, and also as beneficial to the cooperator as we believe it is, we have to find the right way of convincing people of the fact. If we fail it is surely because we have not learnt our job sufficiently well through some inability to understand the opposition with which we are confronted. If we succeed we have the difference between the "compulsory cooperators," who at best will be a poor asset, and the man who is act-

ing on his own free will. We will likewise have a public who see at last that it will pay them to "invest in the future of America"—as one statement has it.

In most areas, though to a much lesser extent in the South, the amount of erosion that was of the more obvious type, easily recognized by an untrained eye, was often all too common and sometimes dreadful to see. One thinks particularly of the stretch of country from Kansas through Oklahoma to Texas. It was impressive, too, to see well-conserved farms surrounded by areas of well-nigh ruined land. Another sharp impression was the contrast between the truly magnificent farms in the parts of Wisconsin visited, with their carefully adjusted arable and animal husbandry, and the succession of farms in eastern Illinois where animals seemed almost non-existent and the rich deep soil was being made to yield little but maize and beans. Arriving there after heavy rains, the many streams loaded with top-soil were an eloquent testimony to the damage that was taking place. Another impressive sight was the strip-mining for coal that is still doing so much damage in parts of Ohio, though here too it was possible to see a great deal of splendid conservation work on many farms.

If the farmer or rancher is not directly approached by the staff of the Extension Service of his state, or by the local Soil Conservation Service technician he is likely to find himself tackled by members of his soil conservation district committee (which have now been formed almost all over the country). Should this not happen it will not be long before the subject crops up when he is talking to one of his neighbors, whose views he has learnt to respect, or when he visits another neighbor who is adopting the new methods. He will hear about it at his farmer meetings, or at the local show. He will see what is going on as he drives about the country, or takes his annual vacation (many farmers travel great distances on such trips). At home he turns on the radio, or opens his farming periodical and finds that the subject is being discussed. His children talk about what has been going on at school, in their agricultural or 4-H club, or perhaps his son wants permission to try out some conservation idea on the farm, whilst his wife may be full of the changes that conservation are bringing to the home of her greatest friend. The post brings him an attractive brochure on the same subject, perhaps from the implement company with which he deals. Or he goes to the bank in search of a loan and they ask awkward questions as to what he is doing to conserve his farm. He will be unusual if he doesn't fancy the idea of a better income, yet his crops are not yielding too well, and he cannot forget that conservation is said to be the remedy. He may resist these influences again and again, but the time comes when he finds that his neighbors are beginning to regard him as backward and old-fashioned. *The time is coming in America, and in some areas has arrived, when a man who will do nothing to rehabilitate his run-down farm, and will not stir himself to take advantage of any of the various agencies now available to assist him, will be exposed to the force of a considerable social pressure, which will be the reverse of that which prevented the adoption of new-fangled measures through the fear of being ridiculed by his neighbors.*

The educational method most suitable to one set of circumstances is often less so in others, so that a wise choice of methods is of importance. For instance, one of the greatest obstacles that often has to be overcome is to convince the farmer that he *has* an erosion problem. Until this has happened it is little use to talk to him about remedial measures, or farm planning.

I have tried in this presentation to summarize the chief reasons why the soil conservation campaign is unable to proceed at an even faster rate than it has already. These reasons are of two main kinds: *The resistance encountered in the field to the adoption of conservation methods on the one hand,* and *the lack of sufficient funds to provide a service that is equipped at all points to meet the demand that has already been built up.* Both of these could be overcome by more and better conservation education, using this term in its broader sense. For if the farmer was sufficiently awakened (and enabled) to apply sound methods of land usage he would become a willing cooperator in his district. On the other hand, if the general public were sufficiently awakened to the destruction of the national resources that is going on from year to year they would insist that a really adequate service was provided, so that the job could be completed with the minimum of delay.

America's Resources Are Vast

Coming from South Africa, with its lack of natural harbors, scanty and erratic rainfall, absence of large tracts of level and rich soils and small population, the immense richness of the natural resources of the United States make an immediate and deep impression which only increases the further one travels. The numerous and fine harbors, the many great river systems, the abundant and reliable rainfall over so much of the eastern half of the country, the immense areas covered by forest, and the vast fertile plains, with their innumerable farms, villages and towns suggest, indeed, that such resources are well-nigh inexhaustible. Is it any wonder that Americans have found it hard to appreciate the need for conservation, especially the need for the conservation of soil, water and trees?

Continuous Plant Cover—The Key to Soil and Water Conservation

J. H. STALLINGS

The second and concluding part of this paper describes other beneficial effects resulting from continuous plant cover; also how the losses of plant nutrients and soil organic matter by erosion are controlled. It shows that the use of continuous cover on the land is the only practical means by which the organic matter content of the soil can be maintained and actually increased. And too, it further emphasises how plants aid in building up and maintaining a high degree of aggregation or tilth and productivity in the soil and how these plants help in preserving moisture by increasing infiltration and decreasing runoff, and consequent soil loss.

WE HAVE SEEN that there is a close and direct relation between plant cover and soil erosion. To provide sufficient protection from raindrops, the plant cover must be dense and continuous.

However, the total amount of soil lost tells only part of the story. Soil erosion was shown to be a selective process (36, 37) since the soil lost from the field usually contains higher concentrations of silt, clay, organic matter, and plant nutrients than the soil from which it was eroded (Figure 6). This may be illustrated further by citing a few specific examples.

In every instance in Wisconsin in 1950, the concentration of nitrogen in the eroded soil material was higher than in the parent soil (17). In many instances it was several hundred per cent higher. In every case the soil and plant nutrient losses were closely related to the amount of plant cover available during the critical erosion hazard period. For example, Fayette silt loam planted to spring oats lost 47,000 pounds of solids; 1,100 pounds of organic matter; 63.7 pounds of nitrogen; 4.05 pounds of available phosphorus; and 7.6 pounds of exchangeable potassium per acre. During the same period a plot of Almena soil planted to corn lost 18,000 pounds of soil; 760 pounds of organic matter; 41.3 pounds of nitrogen; 1.43 pounds of available phosphorus; and 5.1 pounds of exchangeable potassium per acre. In contrast, Fayette silt loam protected by a hay crop lost only 120 pounds of soil; 15 pounds of organic matter; 1.3 pounds of nitrogen; 0.48 pound of available phosphorus; and 2.9 pounds of exchangeable potassium per acre.

Soil type and plant cover were found to have a marked effect on both the amounts and concentrations of plant nutrients lost in runoff (6). These losses are proportionately greater in the summer months when the soluble salts tend to be concentrated at the surface of the soil by capillary action.

The effect of plant cover on plant nutrient losses by erosion is strikingly illustrated in Table 5.

The selectivity of the erosion process is well illustrated by the results of a single storm in Idaho. During this storm the surface soil lost six per cent of its silt, seven per cent of its clay, 20 per cent of its organic matter, and 20 per cent of its nitrogen (9). The surface soil contained 3.05 per cent of organic matter before the hard rain and 2.44 after, whereas the eroded material contained 5.35 per cent.

A field of Norfolk loamy sand in Alabama (so nearly level that it was thought to be free of erosion) lost 60 per cent of the phosphate supplied in the form of 16-per cent superphosphate over a period of 26 years due to erosion (31) (Figure 7). The field was cropped to a 3-year rotation consisting of cotton, corn, and oats during the 26-year period. The phosphates were floated off the field along with the clay fractions of the soil. It was also found that 400 pounds per acre of 16-per cent superphosphate were required on cultivated land to equal in crop production the effectiveness of 200 pounds applied to pastures.

Figure 6.—Organic matter, silt, and clay "blasted" loose by falling raindrops were floated downhill by runoff water in this Illinois corn field to be deposited in depressions or floated off the field. Soil organic matter losses by erosion in Missouri were estimated to be 25 times as great as by oxidation.

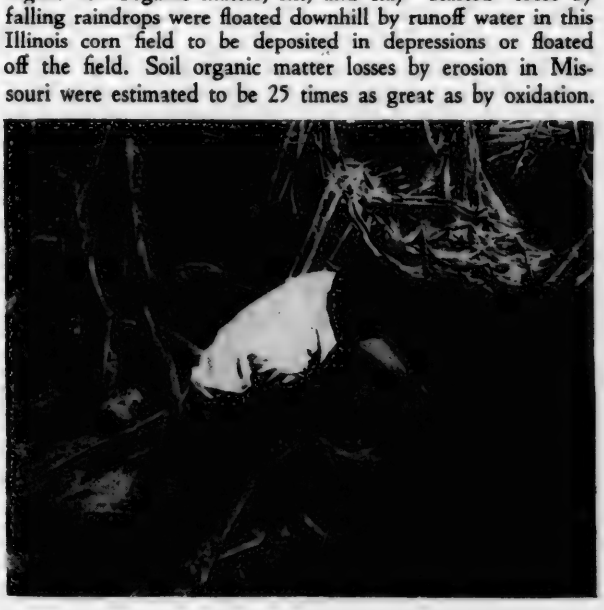

Table 5.—Average pounds of plant nutrients in eroded material removed per acre annually during two-year period May 1, 1926 to May 1, 1928 (26)

Treatment	Nitrogen	Phosphorus	Potassium	Magnesium	Calcium	Sulphur
	Lbs.	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*
Continous bluegrass	0.60	0.16	2.67	0.22	1.07	.....
Rotation: Corn-Wheat-Clover	26.36	6.20	213.86	29.18	86.08	5.97
Continuous wheat	32.39	9.42	264.00	42.67	106.23	8.55
Continuous corn	65.90	18.00	605.30	87.29	220.84	16.66
Fallow	118.13	37.75	1,245.55	171.94	458.51	46.72

Plant Cover Conserves Soil Organic Matter

Without adequate plant cover to protect the soil against the impact of falling raindrops, the organic matter of the soil is quickly removed by the erosion process (25). Without this protection it is difficult—if not impossible—to maintain or even build up the organic matter content of the soil.

The importance of plant cover in controlling erosion and maintaining organic matter is illustrated by studies conducted on Shelby silt loam in Missouri during the 7-year period 1930 to 1937 (33). These studies showed that soil and organic matter losses from erosion were inversely proportional to the amount of plant cover maintained. For example, the organic matter content of soil kept in fallow declined from 3.76 to 2.49 per cent during this period, while that kept in sod increased from 3.65 to 3.91 per cent. The organic matter content of soil planted continuously to corn declined from 3.31 to 2.64 per cent, whereas that planted to a 3-year rotation of corn, wheat, and clover declined from 3.52 to 3.42 per cent.

The treatment which permitted the greatest loss of organic matter also suffered the greatest soil and humus losses (33). To illustrate, land kept in fallow lost a total of 12 tons of humus per acre during the 7-year period, along with 603 tons of soil. Land planted to corn continuously lost 7.4 tons of humus per acre in 371 tons of soil. Land planted to a 3-year rotation lost 39 tons of soil per acre compared with only 1.5 tons for adjacent land kept in sod.

Figure 7.—Fertility erosion in a cultivated field in New Jersey—organic matter, silt and clay were splashed from the sand by the impact of falling raindrops. The washed sand, appearing as light-colored deposits between the rows, was left in the furrows. A light-textured soil in Alabama lost 60 per cent of all the phosphoric acid applied as superphosphate over a 26-year period by this process.

It was estimated that 5.2 tons of clover hay per acre annually would be required to replace the humus lost from land kept in corn; 0.6 ton from unfertilized land cropped to a 3-year rotation; 0.4 ton from fertilized land planted to a 3-year rotation; and 9.2 tons from fallow land.

It was also estimated that if erosion were eliminated, the nitrogen content of the fallow soil (and presumably the organic matter content) could be maintained by the addition of half a ton of clover hay per acre annually (1), despite the fact that this amount was required to maintain the nitrogen and organic matter content on the 3-year rotation plots because of erosion losses. Based on the assumption that the organic matter content of the eroded material was the same as that of the parent soil, the fallow plot lost 18 times as much organic matter by erosion as by oxidation (33). However, during 1935 and 1937 the eroded material contained, on the average, at least 40 per cent *more* organic matter than the eroding soil (43). On the basis of these figures it would appear that the loss of organic matter by erosion was more than 25 times as great as that by oxidation.

Results obtained on Marshall silt loam at Clarinda, Iowa during the same period paralleled those obtained on Shelby silt loam at Bethany, Mo., but at a slightly lower level (33).

Sod crops are sufficiently effective in restoring soil organic matter to offset the destructive influence of clean cultivation and summer tillage (2). Data from Missouri show clearly the destructive influence of summer fallow and, in contrast, the increase in organic matter obtained by using sod crops. When sod was used in a 3-year rotation, with manure from the crops returned to the soil, there was no serious decline in the content of organic matter, as shown in Table 6.

The addition of 2.5 tons per acre annually over a 15-

year period as a mulch of dried and chopped red clover to Shelby loam resulted in a net gain of 497 pounds of nitrogen (1). During the same period the nitrogen content of an adjacent area which received no clover declined a total of 115 pounds per acre. The soil on both plots was spaded in June of each year. After spading, the chopped clover was spread over the surface of one series of plots and left until June of the next year. The other series of plots was left fallow. Averaging these gains on a single-year basis, then 40.1 pounds of nitrogen were added to the nitrogen in the soil each successive year where the organic matter was spread on the surface of the ground.

While the clover treatment of 2.5 tons per acre annually raised the residual nitrogen in the soil above that in the untreated soil by 612 pounds during the 15-year period, the untreated soil was losing 115 pounds. Thus, 18.8 per cent (or almost one-fifth) of this addition would have been needed to maintain the soil at its original nitrogen level. This would have required a half ton of clover per acre annually.

Soil at Guthrie, Oklahoma, which contained an average of about 46,000 pounds of organic matter per acre in 1931, suffered an average annual net decline of 1,860 pounds per acre when planted to cotton during the period 1931 to 1940 (10). When planted to a 3-year rotation of cotton, wheat, and sweetclover, this decline was reduced to 940 pounds per acre. Soil with a sod cover of Bermuda grass accumulated organic matter at the rate of 1,700 pounds per acre annually instead of suffering a decline. The plots planted to cotton lost the equivalent of all the organic matter returned as crop residues and in addition 1,860 pounds annually of the original reserves. The soil cropped to the 3-year rotation lost all of the crop residues returned during this period, plus an additional 940 pounds of its original supply. At the same time, the land cropped to Bermuda grass sod held the equivalent of its original supply of organic matter and accumulated an additional 1,700 pounds per acre annually.

Table 6.—Gains and losses in soil organic matter (in pounds per acre of surface soil) during 17 years, on areas under different systems of cropping and management.

Crop and management	Organic Matter	
	Gain	Loss
	Lbs.	*Lbs.*
Rotation: Corn-Wheat-Clover (all crops removed)		800
Rotation: Corn-Wheat-Clover (manure equivalent returned)	3,200	
Rye and cowpeas (turned under as green manure)	1,200	
Rye turned under—summer fallow		14,400
Red clover continuously—all crops removed	3,600	
Red clover continuously—all crops turned under	9,600	
Alfalfa continuously—all crops removed	10,400	
Grass sod, clipped—nothing removed	10,000	

Plant Cover and Soil Aggregation

Aggregates are the structural elements of soil. Their presence and maintenance are essential to good soil tilth and a high state of productivity. Aggregate formation in soils depends upon adequate supplies of biologically active organic matter (39). The humate fraction of the organic colloids produced in the course of decomposition of organic matter by soil micro-organisms appears to be the major factor contributing to formation of soil aggregates. These organic colloids, or binding agents, are distributed uniformly throughout the soil aggregates and are adsorbed to colloidal clay particles. They effectively produce stable aggregates, perhaps by electrochemical union with organic colloids. Apparently they are bound through the carbon linkage "bridge" between reactive groups on the polymer. This reaction is believed to take place mainly by polar adsorption, resulting from the decomposition of fresh organic matter.

Joined to the soil particles, the humate fraction or hydrophylic colloids serve as bridges between the particles, keeping them from separating yet at the same time holding them apart so they won't pack down tight.

Since certain other groups of soil microorganisms break down these organic colloids as they are formed, it is necessary to maintain a continuous supply of fresh organic matter in the soil if a high state of aggregation is to be maintained. This can only be accomplished by using sod or mulches to which fresh materials are added frequently to produce continuous plant cover (3, 16, 39, 42).

Surface application of several types of organic material was superior to the incorporation of the same materials in increasing the size and number of large water-stable soil granules on Hagerstown silt loam over a 4-year period (3). The surface application of these materials resulted in an increase in the soil organic matter content which was most pronounced in the 0 to 1-inch surface layer. Cornstalks and soybean residues used as mulch increased the number of all sizes of aggregates in the soil (42). Straw mulch was particularly effective in promoting the formation of large aggregates.

The amounts of aggregates of various sizes were strikingly different under sod, mulch, and cultivation treatments in the soil of a peach orchard which had been under treatment for 28 years on Wooster silt loam and an apple orchard on the same type of soil which had been under treatment for 44 years (16). Three types of cultural treatments were used on each orchard. One

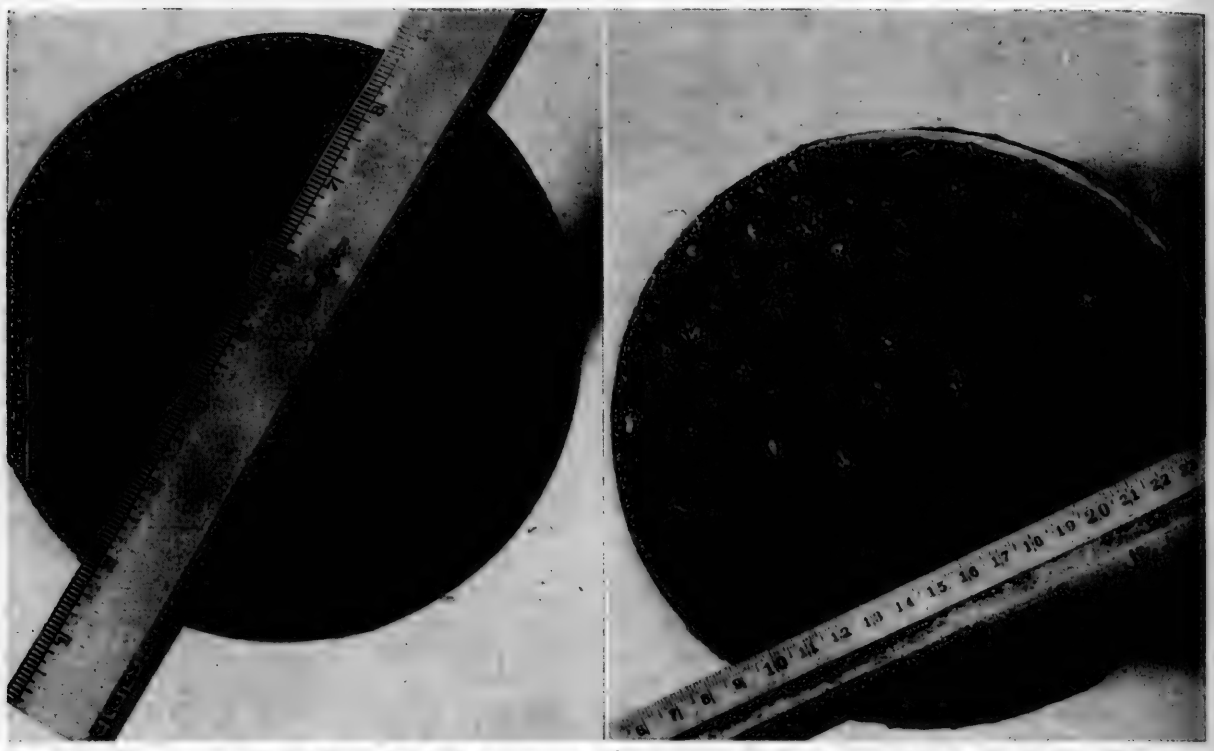

Figure 8.—Plant cover aids the formation and maintenance of aggregates which are essential to good soil tilth. The photographs above are of two samples of Muskingum silt loam taken just across a fence from each other. The one on the right was taken from an orchard which had been in bluegrass sod for a number of years. The one to the left came from a field that had been in cultivation for more than 40 years.

series of plots was planted to cover crops, a second was left in bluegrass sod, and the third was mulched with straw. The cover crops were plowed down and renewed in accordance with usual practices. The straw mulch was renewed frequently enough to maintain a thick covering.

The amounts of aggregates of various sizes were strikingly different under sod, mulch, and cultivation treatments (Figure 8). The mulch showed the greatest amount of aggregates among the largest sizes; sod resulted in almost as much aggregation; the cultivated soil contained only small aggregates. Even in the A horizon, there were few soil aggregates over one mm. in diameter under the cultivation treatment, whereas approximately 28 per cent of the dry weight of the soil under mulch and 23 per cent under sod in the apple orchard were composed of aggregates over one mm. in diameter. The same general trend occurred in the peach orchard.

The state of aggregation was in fairly close relationship to the percentage of soil organic matter in another series of treatments which had been underway for seven years, except for the high aggregate formation under wheat straw mulch (16).

Plant Cover and Infiltration

Falling raindrops have great capacity to erode, damage, and destroy soils. The sharp impact as they strike the bare earth during violent storms shatters the clods and soil crumbs and breaks down the soil structure. The beating, churning action of these drops compacts the fine soil particles into an impervious layer of surface mud, to form "puddle erosion" (40). This compact surface layer becomes denser and more impervious as it strains colloids and other particles from the turbid rainwater that filters from the surface into the soil. This layer is the most important factor affecting the intake of water by the soil. It decreases infiltration (figure 9), increasses runoff and soil loss, and paves the way for gully formation. Puddle erosion can be prevented by keeping the falling raindrops from striking bare soil. This can be accomplished by using suitable plant covers.

Plant cover protects the surface of the soil against raindrop impact by intercepting them and absorbing their kinetic energy. This preserves favorable soil structure and permits rapid intake of water. This plant cover may be composed either of growing plants or plant residues, or both. The most important need is to have ample cover well distributed over the surface of the ground.

Studies conducted in Missouri suggest that plant cover in the form of crops is an important factor in main-

taining favorable moisture conditions in the topsoil. The beneficial effects of sods turned under for corn crops have usually been ascribed to nitrogen, when possibly the important factor has been accumulated moisture in the subsoil. Grass crops absorbed 87.4 per cent of the rainfall; a 3-year rotation with one year of sod absorbed 85.5 per cent, while continuous corn absorbed only 69.6 per cent, according to trials extending over 14 years (26). This amounted to an increased rainfall of 7.2 inches for grass and 6.4 inches for rotation compared with continuous corn. The difference in crop yield was more significant than these figures indicate, since two-thirds of the annual rainfall occurred during six months of the growing season—or the period when differences in rainfall mean increased yields.

Much of the extra water absorbed moves beyond the zone of consumption by the shallow grass roots and is stored there. Thus the deeper soil layer under sod (such as the 24 to 36 inch layer) carries more water than the same layer under tilled soil. Moisture in two similar soils, not far from those in the erosion study cited above, are interesting from this standpoint—especially for the years 1934 and 1936, which were seasons of deficient rainfall. Table 7 gives the moisture content as the percentage of moisture in the successive one-foot layers to a depth of three feet.

The 24- to 36- layer was much drier under the cultivated soil. Considerable time always elapsed after rain before it regained moisture, and its total water content never equaled that in the 24- to 36-inch soil depth under sod. Though the 0-12″ layer under sod had a lower moisture content than that under cultivation during one month (March 1936), in all samplings the moisture supply of the 12- to 24-inch and 24- to 36-inch layers was greater under sod than under the cultivated surface —with the most pronounced differences in the 24- to 36-inch depth, varying from 5.3 to 9.5 per cent. These differences mean that on the average the 24- to 36-foot layer under sod is storing the equivalent of a 1.2-inch rain, which it may supply to the sod crop, or to the deeper roots of the following crop in the drier summer season.

Surface mulching in Pennsylvania resulted in the maintenance of an optimum soil moisture content even during the driest portion of the growing season compared with the practice of wholly incorporating the mulching material (3). Three and four years of mulching with manure, straw, sawdust, corn stover, oak leaves, or pine needles resulted in complete control of surface runoff and an infiltration capacity equal to, and in excess of, three inches per hour. The chief value of mulch in controlling runoff and erosion was in its protective effect.

An abrupt decrease in infiltation capacity followed the incorporation into the soil of a heavy cover crop in orchards in Pennsylvania (4). Several months were required for the development of a suitable soil-plant relationship which favored a high infiltration capacity. Removal of the cover crop from the soil surface by incorporation into the soil or by mowing and removing the clippings increased runoff. The actual ground coverage by plant material and the number of depressions for water detention were the two factors most important in controlling runoff. The amount of material which had grown on the soil but which had been either removed or incorporated into the soil at the time of the trial played a relatively minor role in runoff control. Wheat straw, soybean residue and corn stover used as mulch on a permeable prairie soil in Illinois greatly increased the infiltration rate and reduced the amount of water lost as runoff (21).

Plant Cover and Fertilizer

The addition of fertilizer decreases erosion losses because it increases the amount of plant cover. This is accomplished by stimulating early growth, thus hastening the date when the cover becomes effective, and by increasing the amount and density of cover. High yields and erosion control go hand in hand. Higher fertility means more vigorous crop growth. More vigorous plants provide better cover and produce higher yields.

Two plots in Wisconsin were planted to a 3-year rotation of corn, oats, and hay. The oats in one rotation were fertilized and those in the other were not. The average annual per-acre soil loss over a 5-year period was 47.21 tons for the unfertilized rotation and 13.13 for the fertilized one (18). The use of 200 pounds per

Table 7.—Moisture content at successive depths under sod and under cultivated soil (2)

Date	Sod	Cultivated	12-24″		24-36″	
	0-12″		Sod	Cultivated	Sod	Cultivated
	Percent		*Percent*		*Percent*	
April 1934	27.18	25.23	29.90	24.61	26.11	16.58
November 1934	33.80	31.70	31.90	30.80	32.60	24.80
March 1936	26.30	27.80	28.20	28.90	28.30	23.00
November 1936	27.00	26.80	28.50	27.30	27.80	19.80
April 1937	32.90	28.30	30.00	28.60	30.70	23.40

Figure 9.—Plant cover preserves the open porous structure at the surface of the ground which favors rapid infiltration. Equal amounts of soil were placed in the cups on top of the jars. Mulch cover was placed on the soil in the cup to the left; the other was left bare. Rain was then played on the soil in the two cups for about seven minutes. The greater amount of water in the jar with the mulch cover shows how the mulch cover increased water intake.

acre annually of 5-10-5 fertilizer on land planted continuously to corn in New York reduced the loss of water by one-third and the soil by two-fifths over a 9-year period on unfertilized cornland (22). The unfertilized corn plot lost 9.5 per cent of the rainfall as runoff and 5,934 pounds of soil per acre annually compared with a loss of 6.4 per cent of the rainfall as runoff and 3,552 pounds of soil per acre for the plot receiving the fertilizer.

Unfertilized Shelby silt loam in Missouri planted to a 3-year rotation of corn, wheat, and hay lost an average of 8.81 tons of soil per acre annually during a 7-year period, compared with a loss of 3.69 tons for similar soil fertilized and planted to the same rotation (44).

A comparison of soil loss under wheat and oats (both with and without fertilizer) illustrates the effectiveness of fertilizer in reducing losses by erosion. Soil loss from land in wheat was reduced by one half, while the loss from oats was reduced more than one-half as a result of the increased cover obtained by the use of 200 pounds of fertilizer per acre (34) (Figure 10). At the same time, the wheat yield was increased 91 per cent and the oat yield 77 per cent on the average over a 7-year period by the use of fertilizer.

Summary

Nature employs two distinct steps to build soil. These are the "holding" and "developing" actions. These actions are performed by the countless thousands of types and species of plants that inhabit the earth. These "holding" and "developing" actions operate simultaneously. The "holding" action keeps the soil in place and prevents its removal by the erosive agents, wind and water. The "developing" action changes the parent rock into soil. These actions operate in such a way as to build soil from the top downward.

The primary function of plant cover in the "holding" action is to protect the soil from erosion by absorbing the destructive energy of wind and falling raindrops. Plant cover reduces the velocity of the wind to such an extent that it no longer possesses energy enough to start the saltation movement (the major factor in wind erosion). It also traps soil particles from adjacent areas that may be subject to wind erosion.

Raindrop impact is the major factor in the water erosion process. Plant cover serves as a springy cushion to intercept falling raindrops and prevent them from striking the ground surface before being relieved of their kinetic energy. Raindrops are thus prevented from tearing the soil particles loose and carrying them away in the runoff water. The raindrops are also prevented from puddling and sealing the soil surface. This enables the soil to maintain a high infiltration rate and reduces runoff.

By maintaining a continuous supply of easily decomposable organic matter on the surface of the ground, plant cover produces and maintains good soil tilth. This is achieved by supplying, in the form of leachings, the humate fractions of organic colloids which appear to be responsible for the production of aggregates or crumbs that are essential to good structure.

Plant cover also keeps the loss of plant nutrients and soil organic matter by erosion to an absolute minimum.

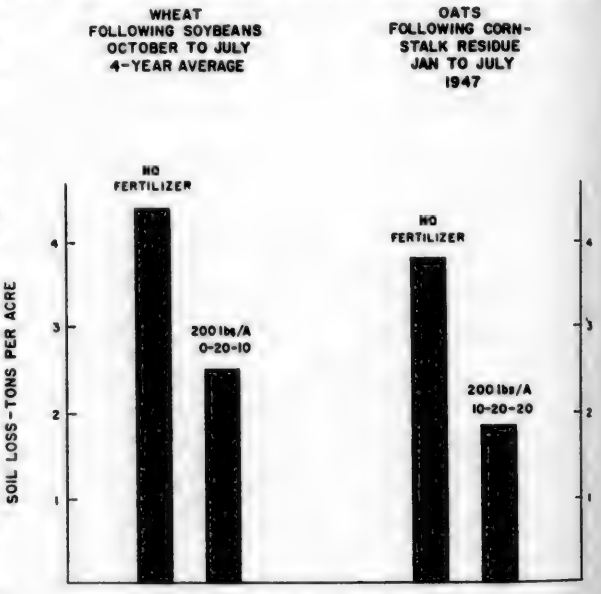

FIGURE 10-EFFECT OF FERTILIZER ON EROSION OF LAND PLANTED TO SMALL GRAIN

Worldwide Technical Cooperation

RAYMOND W. MILLER

DURING THE PAST four years, as a consultant and advisor to the Director-General of the Food and Agriculture Organization of the United Nations and/or to the Administrator of the Technical Cooperation Administration of the State Department, I have traveled in many of the troubled areas of the globe. The world is in the midst of a rural revolution largely because most of its basic economic and social problems are rural; outside of North America and parts of Europe, very little has ever been done to make it possible for the ruralist, who constitutes 85 per cent of the population of the underdeveloped areas of the world, to have a share in the things that science has developed to make a better life in the 20th century.

Friends and associates of mine, particularly those who are fellow-members of the Board of Consultants to the Food, Agriculture and Resources Development Staff of TCA, are unanimous in the belief that the battle of ideas and ideologies among the rural people of the world cannot be won merely by the expenditure of large sums of money. In fact, the spending of large sums often defeats the wholesome purpose for which the money was appropriated. On the other hand, a few technicians in strategic areas making available knowledge gained in other parts of the world are doing a tremendous job of helping people to help themselves. The missionaries of Christendom have pioneered in this, and it can be said without fear of valid contradiction that the foundations for solving rural problems have been laid by the missionary who has gone out into the field and worked with people at the grass-roots level.

Helping People to Help Themselves

FAO, under the leadership of Norris E. Dodd, has followed this concept and has stood against indiscriminate spending of large sums, insisting that no money be spent in a particular area, nor technicians sent there unless the country concerned sustains a fair proportion of the expenses involved. FAO has proved that through the expenditure of relatively small sums on technical assistance the job of helping people in underdeveloped countries to help themselves can make a real beginning. FAO's budget has always been modest, and while increases are needed for its expanding program, the policy of the Organization is to make its funds stretch as far as possible—to accomplish much with little. It is in agreement with the philosophy of the late Seaman A. Knapp, "Father" of the Extension Service in America, who observed that by working from small beginnings, with emphasis on exchange of ideas, a constructive revolution in agriculture is possible.

Beginning with the land grant college, which came in the days of Abraham Lincoln, on through the adoption of the Smith-Lever and Smith-Hughes acts, the establishment of experimental stations, the rise of the county agent and the development of farm credit cooperatives and rural youth movements, America has worked out a pattern based upon a minimum of expense by the Federal Government and a maximum participation by the political subdivisions and individuals involved which can be used as a basis for operations the world over. It fits in perfectly with the principle that FAO has already tested and found to be workable.

By helping people to help themselves through the spreading of information and through technical assistance and advice, FAO is playing a large part in the effort to raise standards of living in underdeveloped countries. One such country is Thailand. Three years ago, under the leadership of Dean R. H. Walker of Utah State College, now assistant director of the Office of Foreign Agricultural Relations, an FAO mission to Thailand made over one hundred recommendations for improving conditions, increasing agricultural production, etc. These were predicated upon the principle of extension service activity, with most of the necessary funds to be derived from local sources. The program was accepted in toto and considerable progress has been made in carrying it out. Among other things, FAO, in conjunction with the Government of Thailand, has been responsible for the eradication of rinderpest in that country.

Missionary Efforts Are Successful

During the past two years I have appeared before one hundred or more audiences in the United States, discussing the idea that most of the world's problems are rural, and while this is a somewhat unusual theme, I have yet to leave an audience with anyone seeming to be in disagreement that this is true and that the way to approach a solution is through the methods mentioned above. I have found that Americans everywhere are responsive to this idea—they understand it, and the missionary and church groups who have tried it abroad know that it works.

I believe that America has an opportunity to take the lead in helping the underdeveloped countries to appreciate the meaning of democracy—the theory of helping people to help themselves. On a multilateral basis the

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This paper by Dr. Raymond W. Miller was presented at the Seventh Annual Meeting of the SCSA held in Buffalo, New York, October 23-25, 1952. Dr. Miller is Consultant for the Food and Agricultural Organization, United Nations.

FAO can do an increasing amount of good. There are many areas where the unilateral approach can be made workable, and I think it can be entirely bipartisan. It is my opinion that activity in this field should be separated from other departments of the government, as in the case of the land-grant colleges and the extension service. I believe that the wholesome concept of Point Four is in danger of failure through good intentions unsupported by a proper evaluation of the problems to be solved or a knowledge of the basic principles of human relations.

We cannot buy friends through gifts and grants. At Allahabad Agricultural Institute in India, a Presbyterian effort, where possibly more work has been done in technical assistance than in any other comparable spot in Asia, they have found that when implements, seeds, etc. are given away they frequently are not used, and certainly not appreciated. Today the mission school sells such things at a minimum price, and they are being widely accepted and used. America with an open heart and hand has tried to save the world by giving things away. It simply will not work. What will work is technical assistance with the participation and cooperation of those who are receiving assistance. In this connection I would like to quote a portion of a statement made by the late Dr. Henry G. Bennett, Administrator of the Technical Cooperation Administration (Point Four), shortly before his untimely death in a plane crash in Iran last December. He said:

"The program we have described to Congress and to the public is a simple, down-to-earth, self-help program designed primarily to assist other peoples in increasing their food production, bettering their health conditions, and improving their educational systems. It is my view that the cost of this program, which will be effective only if it is pitched on a long-term basis, should be enough to finance a broad, dynamic technical cooperation effort, but not to include large-scale grants-in-aid. This has been my consistent position and conviction and I must be faithful to it."

I believe that the Point Four concept, when kept in line with Dr. Bennett's interpretation, is close to the hearts of the men and women who make up our citizenry, and that the use of this principle of helpfulness is the means by which we can make the story of the Good Samaritan live again and at the same time help to save the world from the scourge of eternal warfare.

The Soil Conservation Society of America, by advancing the conservation and proper use of the nation's most valuable resource—its land—has played an important part in making American agriculture the most progressive in the world. *Through its interest in and support of the technical cooperation programs abroad, which in many countries include soil conservation projects, this Society can further the objective of raising living standards throughout the world and thereby promote the cause of peace on earth which is so close to the heart of every American.*

Conservation Comes of Age in Michigan

WILLIAM B. HALL

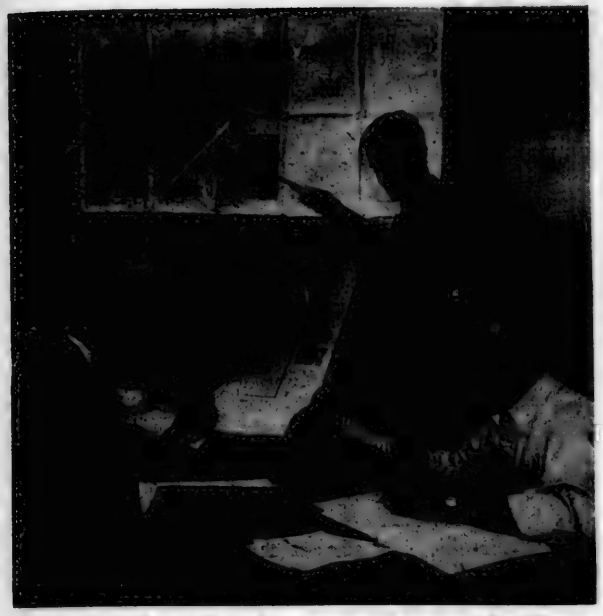
UNTIL GENERAL conservation is recognized as a profession, the conservationist is about as employable as the 19th century lamp lighter in a neon tube civilization. Yet despite the lack of acceptance by industry, business and government of conservationists as professional workers, there is a growing body of students in this country which represents the vanguard of this coming profession.

The reason for this growing interest is simply that something has happened to the United States in the past decade. As a nation we have changed from being an exporting to an importing nation. This change to the import of such materials as oil and pulp is a new experience, and the implications for the future are that we will import more of the materials with which we were once adequately supplied.

Several types of conservation student have already been recognized by the few universities acknowledging the need for general conservation in our educational format. There are, first, the professional resource people, such as the forester or wildlife manager, who wish graduate experience in conservation as a means of attaining the goals of their technical fields. Then there are the graduate students not directly connected with resource management, who come from the academic fields of geography, economics, sociology, political science, botany, journalism, education, and others. Third is the teacher who requires conservation training as the result of growing pressures for conservation teaching at the primary and secondary school levels.

There is, however, a fourth type, not familiar to most campuses, who presents a challenge to our educational mores. He is the man who wishes to be a professional

Wm. B. Hall is a graduate student in the Department of Conservation, School of Natural Resources, University of Michigan, Ann Arbor, Michigan. He is working toward a Masters Degree in Conservation.



These three doctoral students are working on the Charles Lathrop Park Forestry Foundation Project of land use in counties of northern Michigan.

'resource generalist,' a professional conservationist in the broadest sense. He presents a challenge because he recognizes the value of his goal, often ahead of the university he has selected to train him. He has no intention of teaching, and does not wish to be just an economist, forester, soil scientist, or agriculturist. He has every intention of hiring out as a conservationist, if he can, and to attain and work with the prestige of his profession, realizing that he must build that prestige himself until corporations and state, federal and international agencies commonly recognize his profession as bona fide and essential.

The combination of definite knowledge of what he wants to do, and the courage and initiative he brings to his training, puts a new but soluble problem squarely into the laps of the university.

A few years ago the University of Michigan recognized this problem, and through the efforts of Samuel T. Dana, Dean (emeritus) of the School of Natural Resources, and Dr. Stanley A. Cain, Chairman of the Department of Conservation, there is a growing conviction that the training of this particular class of student is a university-wide problem and can not be restricted to the Department itself. This point of view is being furthered by Stanley G. Fontanna, present Dean of the School of Natural Resources, and by the staff of that School and professors of other schools who are actively cooperating in the conservation program.

Basically it is a problem of general education, carrying with it a very essential question of employability. Generally, conservation is taught on a technological basis as part of the training, for example, of the agriculturist, the fishery biologist, or the mineralogist, and emphasis is placed on those aspects relating to the specific resource.

Although there is little precedent, the University of Michigan believes that conservation is an area of its own. It is non-professional only in that it is not yet generally recognized as a profession. Michigan considers it a problem in the integrated development of all resources; to be all inclusive and to go farther than the single resource, but not so far as to fail to see that the problem is partly of human, rather than completely of non-human, technology.

One of the more refreshing aspects of the Michigan plan is that conservation is accepted as a practical problem with a practical application. While this should seem obvious, the subject is treated in some other schools as something of a conceptual scheme alone, as a high-level round table discussion, instead of something to be sold to the public as an integral part of its living.

The School of Natural Resources is, even now, not entirely happy with its undergraduate program. Students approaching the subject as undergraduates must do so in the same frame of mind as in the School of Literature, Science and Art, which, in no university, actually trains a student for a specific job. Hence the undergraduate in conservation will be as unemployable as the liberal arts undergraduate, and he may have the same difficulty at the graduate level. The Department recommends then, that the undergraduate obtain employability in a specific field, such as economics, education, business administration, or one of the resource technologies, before approaching conservation.

Nevertheless, there is still a demand by a growing number of undergraduates to work in conservation. To meet this demand, reorganization of the undergraduate curriculum in 1952 substituted some general education courses for more strictly technical ones. This has provided a broader, more liberal training in the required courses, yet still permits more electives than any other department in the School of Natural Resources. While this curriculum is not a technical course necessarily leading to professional status and employment as a conservationist, it does provide for entrance into many fields, and because it aims at a sound general education, it is a basis for many opportunities.

The undergraduate is expected to complete sixty-five credit hours in English, mathematics, botany, zoology, chemistry or physics, geology, economics, foreign language, literature, sociology and political science. In the School of Natural Resources he will take from thirty-five to thirty-eight hours of forestry, natural resources,

soil study, range management, wildlife management, fishery biology, geography, mineralogy, ecology, or recreational use of wild land. A balance of from twenty-five to twenty-eight hours of general electives remains, affording ample opportunity to explore other fields in and out of the school. This balance includes from four to seven more hours than are allowed by the next most liberal department, Forestry.

Increased liberality in the undergraduate program promotes several aims. In terms of employability it permits a man to specialize to the extent that he can, in a total of five years, take a bachelor's degree in one of the technologies, such as wildlife management which will assure him a job, as well as in conservation. On the other hand, the large number of elective hours permits him to shop around in the other technologies besides his major field of study, thus acquiring a broader background and expanding outlook. If the student's interest is in teaching, he can use his elective hours to obtain a teaching certificate. Again wise choice of his electives assures his obtaining the technical material of his vocation, plus a broad background which enables him to practice in that vocation the far-reaching intricacies of conservation.

The Department of Conservation realizes there is a certain danger of superficiality, yet feels, in view of the desires of the embryonic resource generalist, that he must have knowledge of the several natural resource fields. He must also bring to his work a curious mind, interest in interrelationships, social conscience, faith in himself and man, and managerial ability. To face this barrage of requisites the student must bring greater courage to the campus than those who are to teach him—for they are already employed.

Conservation education for the post graduate poses a university-wide problem and requires top administrators, department heads, deans and individual professors to recognize it and remove all possible barriers from the way of the student.

As taught in most schools, the professional fields require, as the result of professional competition, a rapid accumulation of training, rather than education. However, the difficulty is that many problems of the specific field and the complex conditions of our society call for a wider comprehension of the relations between all resource fields. Since resource management has meaning only in relation to human use, general conservation becomes involved largely in the economic, political and social implications of resource development and distribution.

Many men with competence in some technical resource field find that their work is only partly technological, and that more and more of their time must be spent working directly with people in many other fields. Thus they may return to school for graduate study in such fields as economics, government, sociology, survey research, group dynamics, international resource development, integrated land management, land planning or conservation policy.

Realizing that the needs of the graduate student in conservation go beyond the requirements of technology, the Department has established a number of courses under instructors from other departments as well as under its own personnel, in which the resource interrelationships are stressed.

As a result, the Geology Department cooperates in giving a course in mineral resources in which the effect of the geologic and geographic concentrations of strategic minerals, and the social consequences of existing political and commercial control of important mineral resources are stressed. A course under the Mineralogy Department considers the occurrence and importance of the world's non-renewable mineral resources, metallic and non-metallic, and stresses the economic, technological and sociological considerations concerning their conservation and production. The Geography Department gives a course concerned with the problems of land use and conservation, with broad regional analyses of populations and industries in North America.

The College of Architecture and Design provides course work in urban and regional planning in which a critical examination is made of the development prob-

A group of leaders representing business, industry and finance on a field trip viewing gas and oil operations in Michigan.

lems of present day cities and region, and the application of modern planning practice is studied in their solution. Another course concentrates on the organization and legal basis for urban and rural planning surveys, and on the preparation and carrying out of the plans.

A committee of faculty representatives from the departments of forestry, architecture, civil engineering, public health, economics, geography, political science, landscape architecture, sociology and real estate, conducts a seminar in which surveys are made of the broad fields of land utilization and regional planning and development from various viewpoints.

Within the Department of Conservation itself, new courses have been introduced including a workshop in the teaching of conservation for prospective teachers at all levels. In addition, course work is available in international resource problems, land management and conservation policy, and natural resource economics, while conservation trend seminars serve other needs of conservation students as well as those of students from other departments.

Course work in resource law, soil and water conservation, a single introductory course in agriculture, much like the survey introduction to economics, botany, or sociology, are still needed. And for the future, courses in the political and public administration aspects of resource development are anticipated.

Justification for graduate work beyond the requirements of a master's degree is found in the vocational goals of conservation education, in governmental or industrial fields. A specific example is the graduate student with professional competence in engineering and public health who wishes to work in the field of water conservation. His doctoral program grants him a Ph.D. in Conservation, and equips him professionally to work in his desired field, but does not require him to take many of the engineering or public health courses necessary to obtaining a doctor's degree in those fields; yet does enable him to concentrate on the engineering or public health aspects essential to his vocational goals.

There is no reason for the Department of Conservation at the University of Michigan to become large staffwise, yet it must offer a large field of courses, and can become larger in terms of enrolled students. The Department provides a focus for the program planning for graduates, utilizing and enriching the resources of the entire university, in part by availing itself of the services of part-time professors from other schools and other departments within the School of Natural Resources.

Currently the Department carries on a multiple phase program which includes teaching, research and public relations. With respect to teaching, the Department has made some innovations. For example, in the course in international resource development visiting lecturers are used abundantly. These may be professors from any part of the University, such as economics, political science, geography, or the humanities, who have had recent experience overseas, or they may be foreign students or visiting specialists who know about countries where the United States has technical assistance programs.

Another course makes an effort to discover significant trends in the conservation movement, but also is a means of teaching students from all backgrounds to think on their feet and to verbalize. To this purpose their presentations are tape-recorded, and are available for playback to the student.

In addition are the research projects, such as the integrated team problem on land use conducted by three doctoral students and financed by the Charles Lathrop Pack Forestry Foundation.

A third phase is the public relations program which takes the form of speeches, conference participation, popular articles, TV programs and radio addresses. For example, an eight-week TV course in conservation was given by Professor Shirley W. Allen of the Departments of Conservation and Forestry in the fall of 1952. Keynote addresses have been made by Dr. Cain at the AAAS Centennial in Washington in 1949, the Beloit Conference in 1950, the Second Regional Conference on Conservation of Natural Resources at the University of California in 1951, and at the Oregon State College Biology Colloquium in 1952. Some fifteen to twenty extension talks are made off campus each semester.

The Higgins Lake Conservation Conference in 1952, in which leading Michigan businessmen, industrialists, and financiers participated, was planned with the active help of Dr. Dana, Dr. Cain, and Dean Fontanna, and represents an important new phase of the conservation movement.

Dr. Richard Weaver, of the Department of Conservation, carries on extenive work in conservation teaching and education with the National Education Committee. Finally there is the direct contact in the field with individuals and organizations, including schools, working in conservation.

This, then, is the University of Michigan's conservation program. It is a continually developing and earnestly searching process to turn out men equipped to see a human problem in terms of the far-reaching and delicately interbalanced factors whose proper interpretation will have much to do with the future of this nation. It is a program conducted at a level which permits wide latitude, develops broad perspectives, and illustrates the beginnings of the university-wide recognition of a universal problem and the best methods of preparing students to face and solve it.

Torrent and Avalanche Control

The French Government was recently host to some 45 foresters attending a study tour on torrent and avalanche control. Recommended by FAO's European Commission on Forestry and Forest Products, this study tour across the Alps from Nice to Evian, 28 June to 8 July, was admirably organized by the French Forest Service. Representatives of the following countries attended: Austria, French Union, Germany, Italy, Iran, Spain, Switzerland, Turkey, United Kingdom (Cyprus), and Yugoslavia.

The Director-General of Waters and Forests, France, in his speech of welcome to the delegates at Nice, gave a lucid account of the present forestry situation in these regions, emphasizing the close relationship of torrent control with soil conservation and land use generally, and with the whole manner of life in mountain districts.

A full report on the study tour is being published separately but the following brief notes give an idea of the ground covered. In the southern Alps the members were able to study the problems of torrent in streams which normally carry little water or are entirely dry, but which become exceedingly dangerous after local summer storms which sweep down into the valleys rocks and debris, large and small, which have accumulated in the upper reaches of the catchment areas. In Savoie and Haute Savoie, they saw torrents which carry a steady flow of water and which are constantly eroding their banks; when in spate, these torrents seriously endanger villages and croplands which lie along their courses, and roads and railway lines which cross them. In both these regions, it was also possible to study problems of protection against landslides and avalanches.

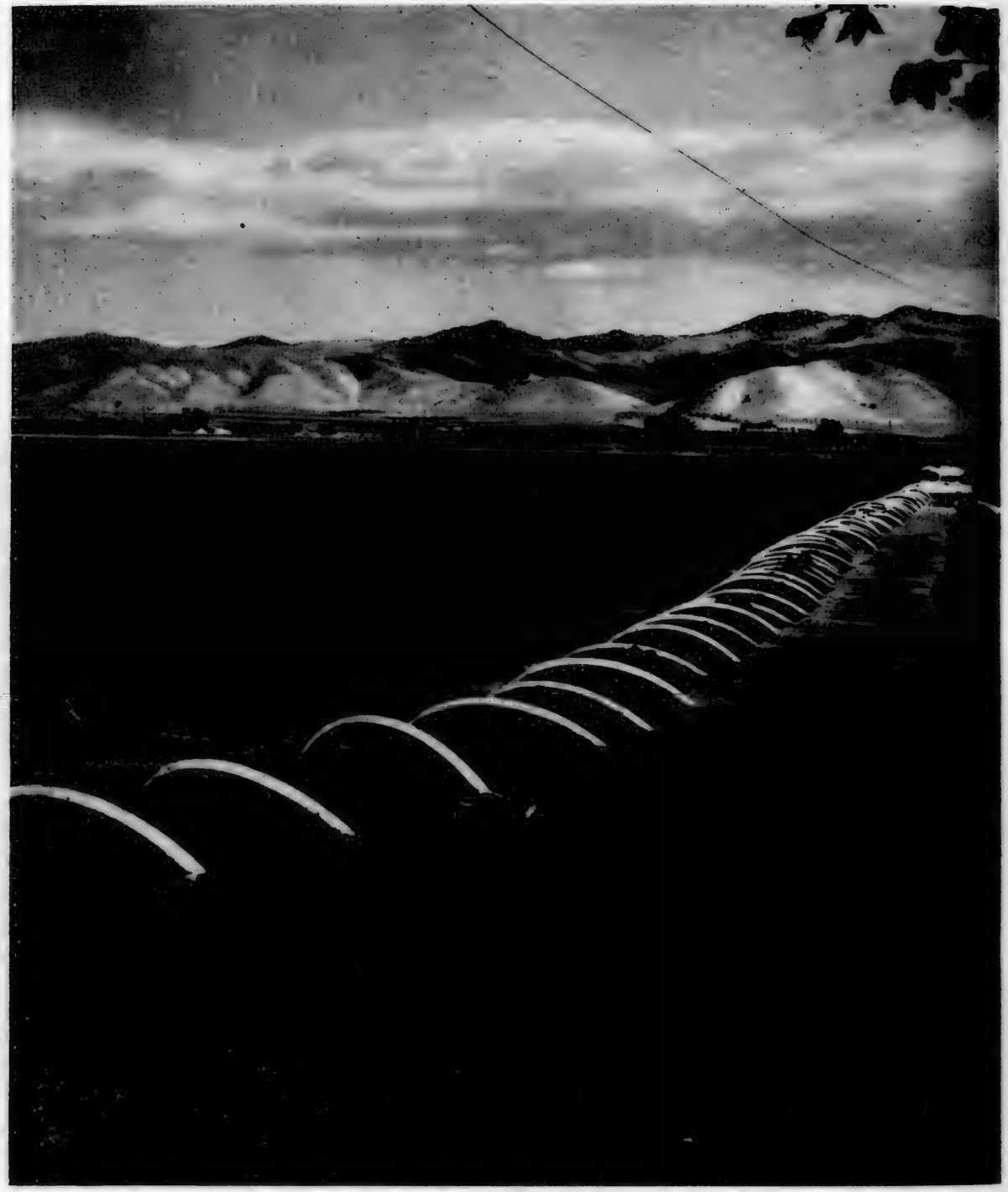
Torrent Control Important to Rural Communities

Two points in particular attracted the attention of members. One of the highlights of the tour was a visit to Serre-Poncon on the river Durance where the construction of a large dam is proposed to feed a hydroelectric plant and irrigate the lower valleys. The engineers in charge of this project explained the dangers that they foresaw if there should be any negligence in maintaining and extending the forested areas and control works which were the only means of holding in check the erosion caused by torrents emptying into the upper reaches of the Durance. The construction of this dam, they said, would completely change the aspect of the region, and present new problems in the control of torrents emptying into the river not only above but also below the dam. Study of these problems was still in an early stage, but clearly the construction of large dams of this nature brought new responsibilities to all those concerned with torrent control; this pointed evidently to the necessity of the closest cooperation between foresters and the dam engineers. Inasmuch as the catchment area of a river forms a unit where the utilization of any one part affects the potential utilization of all the other parts, so too the river itself with its tributary system constitutes a unit which cannot be effectively developed unless every part is fully under control.

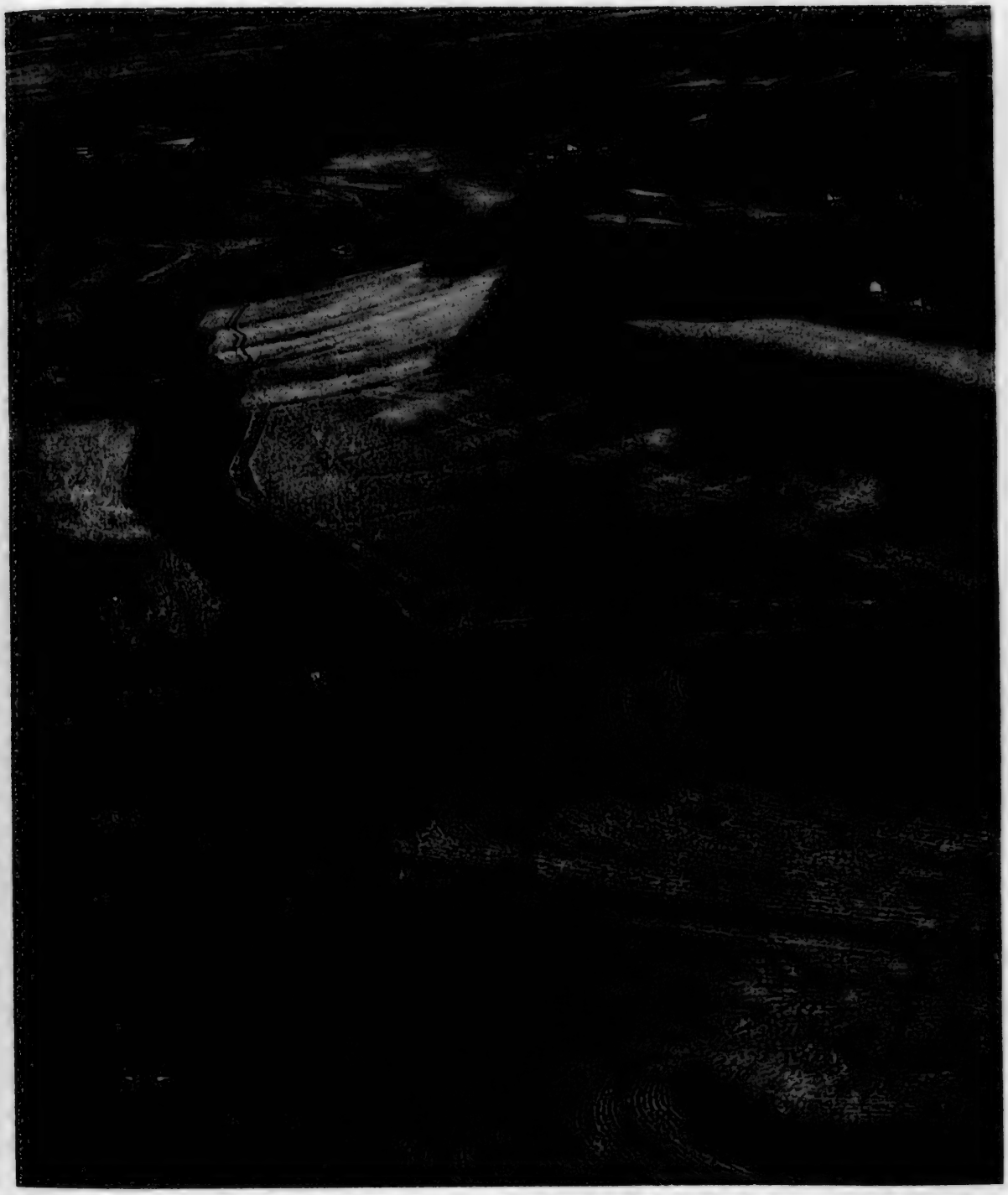
The second point to impress the members was the evident interest which the tour aroused in the districts through which they passed. Local spokesmen frequently made clear the importance that rural communities attached to torrent control. They were well aware of the role that forests played in the protection of soil and regulation of waterflow, and therefore had an especial welcome for those who were responsible for protecting their forests, and for extending the forests as new erosion dangers emerged to threaten their possessions and their homes. Thus the members of the tour were made fully aware of the complex relationship between the particular problems which they were studying and the general background of living conditions in mountainous districts. As the Director of FAO's Forestry Division pointed out at the closing discussion session, torrent control is in itself a difficult operation, which, even at the price of large capital expenditure, is not always crowned with success. Success is certainly hazarded wherever excessive forest exploitation, over-grazing at the higher altitudes, or wrong agricultural practices are permitted on lands subject to erosion. The problem is fundamentally one of correct land use. On its solution depends the welfare and social development of the rural communities affected. They may decline and perhaps disappear; on the contrary, they can attain improved standards of living and well-being if their natural resources are cared for instead of being allowed to deteriorate.

For the present, the members of the study tours were confining their attention to what might be called the chronic diseases of the land and the possible remedies. Improvement of grasslands beyond the tree-line was not now their concern, but it was clear that, sooner or later, they must take into account all the complexities of land use in mountain areas. FAO's aim was that, in alpine regions, the interests of agriculture, forestry, hydroelectric engineering, and tourism, should all be harmonized. —*From* UNASYLVA, Vol. VI, 3: September, 1952, 135. (Unsigned—one of several items under General Heading "The Work of FAO.")

These two men are discussing the importance of a complete conservation farm plan; also the soil and water conservation measures needed to improve and maintain the fertility of the land.



A truck crop farm near Hollister, California, depends upon furrow irrigation for water. The water level in the head ditch must be above the level of the adjoining field.



This series of floodwater-detention and desilting structures are located in the Habinck sub-watershed of the Little Sioux basin near Smithland, Iowa.

Cattle being brought in from the grass rich bluestem hills of Osage County, Oklahoma, to separate weaned calves from cows. Note the excellent grass cover.

Some Aids in Evaluating Sheet Erosion in the Northeastern States

ARNOLD J. BAUR AND HENRY R. ADAMS

ALTHOUGH SHEET EROSION is usually evaluated in terms of inches or percent of original topsoil (1) lost, (2), (3) there are many conditions under which it is very difficult or impossible to make an evaluation on this basis. Soil deterioration by erosion may take place even though such erosion cannot be measured or classified by the usual standards. Therefore, it is important to have an alternate set of criteria for use in evaluating and classifying sheet erosion.

In this paper the authors list the factors that can be used to judge the degree of erosion where inches or percent of topsoil lost is not dependable, and define Erosion Classes on the basis of those factors. The list of factors and the erosion classes are mainly a result of experience in mapping and classifying erosion in soil surveys (soil conservation surveys) in soil conservation district in Northeastern United States. The principles involved, however, can be applied to other regions. Reitz (4) has shown some of the factors pictorially.

Some soils, as seen in their virgin condition, lack strong or deep profile development. The upper soil horizons, which normally can be recognized by color, texture, structure, or other precise feature, may be poorly developed, or if present, may be only a fraction of an inch to a few inches in thickness. The Brown Podzolic (5) soils, for example, under forest vegetation have a surface mat of organic matter. This is underlain by a strong brown or yellowish brown horizon that gradually becomes paler with depth, but otherwise there is no visible change down to the parent material that is encountered at a depth of 20 to 30 inches.

In the Podzols (5) the forest organic mat is underlain by a distinct gray layer that, in turn, is underlain by a strong brown orterde. These layers under the organic mat, especially on the minimal side of the modal profile, may total only two to six inches. Underneath these very distinct but thin horizons is the paler yellowish brown subsoil and gray parent material similar to that in the Brown Podzolic soils. There is also a group of soils in which the soil carries a strong color inherited from the parent rock such as red shale. This color is very persistent and masks any color differences that might normally develop during the processes of soil formation, and

Arnold J. Baur, a member of the SCSA, is state soil scientist for New York with headquarters at Ithaca. Henry R. Adams, also a member of the SCSA, is regional soil scientist for the Northeast Region. His headquarters are at Upper Darby, Pennsylvania. Both men are employees of the Soil Conservation Service.

Figure 1.—Deposition at the fence line is evidence that soil has moved down the slope. In this picture, the soil was held by sod in the corner of the field. The deposit is over 30 inches deep, and came from a watershed of two acres.

makes it difficult or impossible to recognize the different layers by ordinary field methods.

In all of these cases, the use of the plow mixes any thin or incipient top layers with the material beneath, so that they lose their identity. This creates an artificial plow layer or surface soil very similar to the underlying material except that it usually contains more organic matter. When sheet erosion removes some of this surface layer, the plow simply goes deeper and bring up more of the sub-surface material to be incorporated in the plow layer. Under such conditions new topsoil is being produced continually. Thus it is obviously impossible to evaluate sheet erosion in terms of the amount of topsoil lost.

Soil Deterioration

Inasmuch as the surface soil and underlying material are so similar it may appear that sheet erosion is not important. It is possible that the loss of a certain amount of soil is not as serious on these soils as it is on soils with a great difference in the texture or structure of the surface soil and subsoil. Even on the soils described, however, sheet erosion may produce significant changes. Sheet erosion is a selective process (6), (7) taking more of the organic matter and the fine materials that carry the available nutrients, and leaving the more coarse, inert materials. In many gravelly, flaggy or stony soils this results in the development of an erosion pavement—an increase in the proportion of those inert rock fragments in the surface soil. In practically all soils this selective removal also results in deterioration of the structure of the material that remains. Another reason for

Figure 2.—This kind of soil washing will be covered over by the next cultivation, but its presence is a clue to the classification of erosion on this field. It also gives an indication of the soil loss that may occur on other fields with similar soil and slope conditions when cultivated.

the significance of erosion is that many of these soils have a limited depth of material in which water and nutirents are available to plants. Naturally, the loss of any appreciable part of this depth makes the conditions less favorable or suitable for plant growth. The recognition and evaluation of past erosion is important too, because it provides evidence that the tract lies in such a position that erosion has occurred and will continue to occur unless steps are taken to prevent it. This evaluation may also provide some information on the relative erodibility of various soil types.

Since the plow layers of both uneroded and the less severely eroded areas of such soils have about the same physical composition and appearance, it is difficult to evaluate sheet erosion by observing the physical characteristics of these soil layers or horizons, or to assign numerical values to erosion in terms of percentage or inches of topsoil lost. This does not mean that we can't arrive at a fairly accurate picture of erosion conditions, but these evaluations are relative or comparative and not actual measurements of the amount of soil lost. They are not based primarily on the thickness of soil horizons, but are derived by interpreting observations of other conditions such as:

Surface evidence of sheet, rill, or shallow gully erosion.

Development of an erosion pattern of waterways since the land was cleared.

Accumulation of sediment in low places or behind hedges and fence rows.

Depth to unweathered material or depth to some other lower horizon or layer where observation of virgin areas has shown that this depth was relatively uniform in uneroded soil.

Presence of an erosion pavement.

Color change in the surface soil due to admixture of material from lower horizons.

Condition of the vegetation.

Soil Erosion Classes

Using such criteria as a basis, it is possible to divide sheet erosion conditions into several classes that are of significance in planning the use and treatment of the land.

Class 1: *Little or no significant water erosion.* Erosion has not been sufficiently active to remove a significant amount of soil or to produce any significant or readily perceptible changes in the physical characteristics of the soil. There is no evidence of sheet erosion, rills, or shallow gullies; no evidence of an erosion pattern; very little or no evidence of accumulation in chanels, low pockets or behind fence rows; fairly uniform depth to unweathered material or to some other easily identified layer.

Erosion has not developed to the point that it threatens the productivity of the land or has become a hazard to various land uses. Few or no conservation measures are required as a result of past erosion.

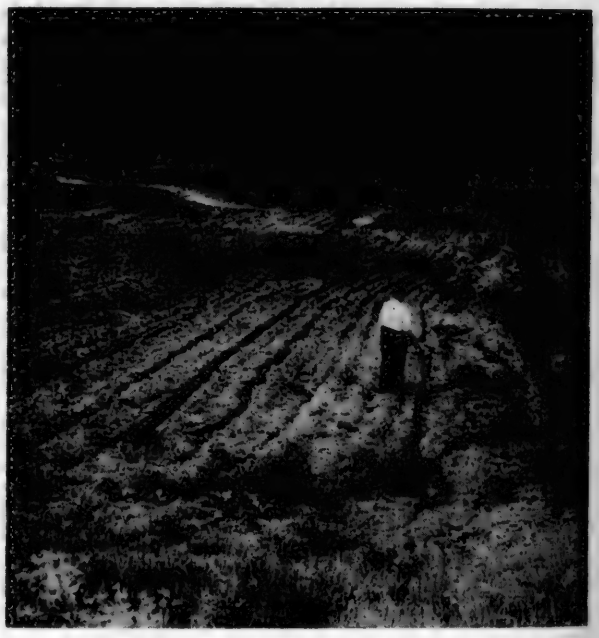


Figure 4.—Erosion on this field is classed as severe. The development of an erosion pattern of waterways can be seen through the center of the field and in the foreground down the slope. The rills parallel to the planted rows will be eliminated by plowing next year, but their presence at the time of examining this field can be used in classifying erosion. The slope is 10 to 15 per cent.

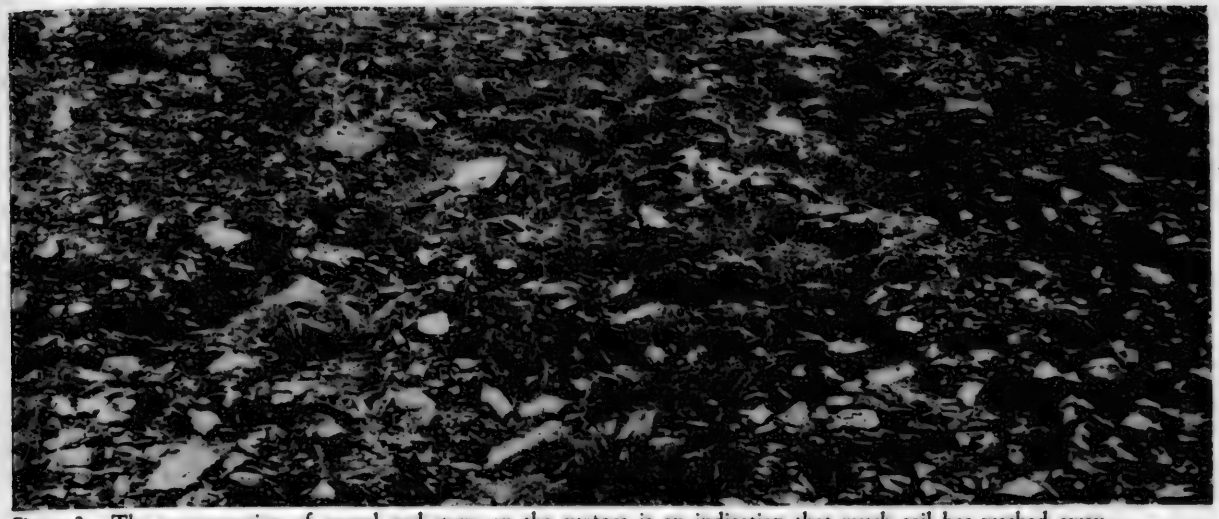


Figure 3.—The concentration of gravel and stone on the surface is an indication that much soil has washed away.

Class 2: *Moderate sheet erosion.* Erosion has progressed to the point where the removal of a significant amount of soil can be recognized but the original soil characteristics are still very evident. Some or all of the following features may be observed: Active sheet, rill, or shallow gully washing; deposition of topsoil material in channels, low pockets and behind fence rows; some accumulation or concentration of coarse rock fragments in the surface soil; depth to unweathered material or to some other horizon is shallower than on uneroded soils; in some cases the color or texture of the surface soil shows admixture of subsurface or subsoil material; evidence of the development of an erosion pattern since the land was cleared.

Erosion has developed to the degree that it threatens the productivity of the land or has created a moderate hazard or limitation to the use of the land. Although the actual productivity of the land may not have been greatly impaired, immediate application of protective measures is required to prevent serious damage, especially on cultivated areas or areas without good vegetative cover.

Class 3: *Moderately severe sheet erosion.* Erosion has removed all or nearly all of the original surface soil and some of the subsoil. The effects of this are perfectly obvious and easily recognized. Active sheet erosion, rilling or shallow gullying are present, or the effect of these actions can be observed; a definite erosion pattern may be present; on gravelly or stony soils a definite erosion pavement has developed; deposition is clearly evident at the foot of the slope; the color and texture of the plow layer is definitely influenced by admixture of the subsurface or subsoil, rather than resulting from a mixture of the surface layers.

The productive capacity of the soil, unless rebuilt, has been materially reduced or other severe hazards and limitations have been created. Intensive soil conservation and soil improvement measures are required continuously to prevent further soil damage.

Class 4: *Severe sheet erosion.* Erosion has removed much of the solum (the soil profile above the parent material), or has greatly reduced the depth of material from which roots can obtain moisture and nutrients. Surface indications of past or present erosion are apparent and the loss of soil depth is obvious.

The use capability of the soil has been limited, and the productive capacity, unless rebuilt, has been greatly reduced. The immediate application of soil conservation and soil improvement measures may prevent further loss, but is not likely to restore all former use potentials or productive capacity. For example: Such land could probably be made to produce good hay and pasture, but would not be suitable for intensive cropping of corn and potatoes.

Class 5: *Very severe sheet erosion.* All, or practically all of the weathered material has been removed leaving bare rock, shattered rock, or unweathered unconsolidated material. The productive capacity of the soil for ordinary farm products has been reduced to a very low level or practically destroyed, although low grade vegetative cover may grow and afford some protection against further loss. The areas with this erosion need protection to prevent the removal of material that may be deposited elsewhere to the detriment of good land. (Where rock is not too close to the surface, areas of this erosion may be improved so that it is possible to get economic yields of some plants).

(*Continued on page* 89)

Some Notes on Early Conservation Practices

E. D. KNIGHT

AGRICULTURE IS AS OLD AS MAN. The word itself comes from the Latin "*ager*", field and "*colere*", to cultivate. Since the beginning of antiquity the customary and accepted definition has been the utilization of the soil to produce the requirements for human subsistence, which accordingly embraces the husbandry of livestock as well as the planting and harvesting of crops.

It is obvious, therefore, that agriculture antedated civilization and was practiced in some limited form by the most primitive of peoples. The simplest type of agriculture has been termed "*extensive*," and consists of raising crops or pasturing livestock on one piece of land, without resort to any improving practices, until the land is exhausted, whereupon it is abandoned and a move is made to a fresh location. This was the form of agriculture when all humans were nomadic or semi-nomadic.

So basic was agriculture that the ancient civilizations ascribed to it divine origin and Isis in Egypt, Demeter in Greece, and Ceres in Rome were accredited as its founders. It was within these venerable nations that the science and art of "*intensive*" agriculture was apparently first conceived. Again, as in the matter of Vivaria, it is to the pictorial relics of ancient Egypt that we must turn for the earliest information on farming.

Just when the art of assisting the processes of nature, by supplying elements that were wanting and by putting back into the soil other elements that were being exhausted by cultivation, actually came into practice is of course conjectural. The records of Egypt indicate that the principles of irrigation were well understood along with some ideas concerning fertilization, while the preparation and planting of the seed bed differed only in the matter of implements used from the most common practices of today. The Egyptians plowed with crude plows and harrowed by breaking the clods with hoes. Having no drills or culti-packers, they broadcast the seed by hand and then, as soon as the sowing was complete, drove flocks of sheep over the fields to press the seed into the ground with their hooves. As far as fertilization is concerned, the Egyptians were fortunate since the Nile more or less automatically took care of that feature by inundating the land near its banks with pleasing regularity and depositing rich soil and other organic matter.

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Greece, whose mountainous land was better adapted to the culture of vines than grain, was not a vital factor in the development of intensive agriculture. Along with the Egyptians the Babylonians, Israelites and Romans are classed as the great agricultural nations of antiquity.

Little is known of Babylonian husbandry. The Hebrews practiced a sort of regulated agriculture with the land divided into small farms under an agrarian law of the Mosiac Institute and held in direct tenure from Jehovah. They irrigated and fertilized and under the law every Seventh or Sabbatical year the land had to lie fallow, which further helped to prevent its exhaustion. Each Israelite husbandman was, in the modern sense, a tenant farmer of the Lord and the law further prohibited the charging of interest and provided a cancellation of all debts against the land every seventh year. Under this benign system Hebrew agriculture prospered and developed a high degree of efficiency. It is perhaps not too far fetched to say that some of our present-day governmental aids to agriculture have at least a tinge of Biblical precedent.

It is, however, to Roman agriculture that we must look to discover the most comprehensive application of practical farming principles as we know them today. One reason, of course, is that Roman writers were more prolific and specific on this subject than the agricultural historians of other nations.

It would appear that most of the farming practices which are considered sound today were well established when Rome was in its glory. Practical irrigation systems, including that predecessor of the modern pump —the water wheel—actually antedate Rome; as do also seed bed preparation including plowing, harrowing, and impressing the seed into the soil. The Romans were number one fertilizers. They carefully husbanded and put to good use all available manure from their domestic animals and poultry. In fact so zealous were they in this connection that they went a step further. In discussing the manure-heap Varro says: "*In the manure-heap some place the slaves' privies.*"

Soiling crops, so called "green manure," were also used by the Romans to enrich their land. Again quoting Varro: "*Some things should be sown with a view not so much to present profit as to next year's crop, because when cut down and left there they improve the soil.*" As a matter of fact grain was generally cut high on the stock and such crops as beans pulled, leaving the stalks standing so they could be plowed under as or-

ganic fertilizer. This latter practice also antedates Roman agriculture.

Varro further mentions that in Transalpine Gaul, in the interior near the Rhine, non-organic fertilizer in the form of "marne"—a natural mixture of lime and clay—was used to dress fields of poor soil which was not naturally productive.

Some of the other practices common to Roman agriculture were:

1. The draining of wet land; 2. the ensiling of grain and grasses; 3. the planting of legumes on thin soil; 4. the rotation of crops; 5. the construction of terraces, and 6. the storing of hay under roof instead of in stacks "for so it makes sweeter fodder."

Virgil in his "*Georgics*" even speaks of the treatment of seed to increase production. As he phrases it: "*Some steep seed in soda and oil lees to get a larger produce.*"

Overall the cardinal principle of Roman agriculture was proper land use and many pages were written concerning a broad program of adapting each acre to the crop to which it was best suited be it pasture, meadow, grain, truck garden, vine, fruit tree or forest. The ancient definition of an acre was "The amount of land which could be plowed by a yoke of oxen in a day."

Agriculture in Rome was considered the leading civil profession. The Encyclopedia Britannica states: "*Agriculture was highly esteemed and classed with war as an occupation becoming a free man. The story of Cincinnatus, twice summoned from the plough to the highest offices in the state, illustrate the status of the Roman Husbandman.*"

Roman agriculture declined with the fall of the Empire and agriculture in general was neglected during the Dark Ages. It was revived by the Saracens in Spain and the Moors, who succeeded them, are credited with recreating an agriculture equal or superior to any which had preceded it. It is believed that practical treatment of plant diseases first came into the picture as a part of Moorish agriculture.

The history of agriculture presents an important argument for the system of free enterprise. Egyptian agriculture was made up of great estates individually operated; Roman agriculture flourished both under this system and earlier when the land was divided into a number of smaller holdings; Israelite agriculture became great with each man farming his own allotted acreage. English agriculturists developed the "know-how" and made it available through the publication of a number of worthwhile treatises several hundred years earlier, but it was not until about the beginning of the 19th Century that the British finally threw off the yoke of communal husbandry and their agriculture really flourished. It is interesting that contemporary Russia has adopted the one system of agriculture—communal farming—which history, with a few and small exceptions, has proven to be a dismal failure.

England apparently owes much of its agricultural advancement to Flanders where, during the 17th Century, the science of agriculture had developed into a high art. Sir Richard Weston was ambassador to Flanders under the Commonwealth and after his return to England, his "*A Discourse of Husbandry* used in *Brabant* and *Flanders;* shewing the wonderful improvement of Land there; and serving as a pattern for our practice in this Commonwealth," was published in 1650 by Samuel Hartlib and dedicated to *The Right Honorable the Council of State.*

Sir Richard's opening paragraph reads as follows: "It is a certain thing, that the chiefest and fundamentallest point in Husbandrie, is, to understand the nature and condition of the Lands that one would Till; & to Sow it with such Seeds, as it will produce either Naturally, or by Art, that which may turn to a man's greatest profit and advantage. I did think I had understood that point (when I went out of England) after thirtie years experience in Husbandrie (and having improved my Land, as much as anie man in this Kingdom hath don both by Water and Fire. But, after I had been a while in Brabant and Flanders, I found I was to learn a new Lesson, in point of Husbandrie; for that the barrennest, Heathie and Sandie Lands in those Countries did produce richer Commodities, by an ordinarie waie of Husbandrie there in practice, then the strongest and richest grounds that were in both those Countries."

The successful Flanders agriculture upon poor land was based on a rotation of crops suitable for light sandy soils along with proper soil treatment. The turf was first burned, which was called "devonshiring." This was done by scraping such sod as was present into hills and letting it dry out before it was fired. Sometimes additional organic matter such as ferns from the woods was added to the hills. After the firing, lime was also added and mixed with the ashes and the mixture spread and plowed and harrowed in. Flax was then planted and harvested by pulling. This occurred in midsummer and a crop of turnips was then planted for fall harvest. The next spring oats were planted as a nurse crop with clover or clover alone. The land was left in clover for hay or pasture or a combination the year following the planting and then the treatment and rotation was repeated. The same system of treatment and rotation was successfully applied to a successive crops of wheat, oats, and clover.

There appears to be no question that British knowl-

edge of clover culture, on which by 1655 they were practically as well informed as we are today, and likewise the popularity of turnips as a fall crop, and the increased use of lime came from the example of agriculture in Brabant and Flanders.

A number of the early British works recommended systems and methods that would today be considered good soil conservation practices. It remained, however, for Walter Blith, "a Lover of Ingenuity," to pen the first volume in which a complete and comprehensive system of soil conservation was advocated. The first edition of Blith's compendium was published in 1649 and was printed by I. Wright at the King's Head in the Old-Bayley. It was entitled "The English Improover or a New Survey of Husbandry. Discovering to the Kingdome, That some Land, both Arrable and Pasture, may be Advanced Double or Treeble; Other Land to a Five or Tenfold; and some to a Twenty fold Improvement: Yea, some now not worth One, or Two shillings per Acre, be made worth Thirty, or Forty, if not more. Clearly demonstrated from Principles of sound Reason, Ingenuity, and late, but most certaine Realll Experiences."

Blith was intense on proper land use. It is his basic theme throughout. He wanted every single acre without exception devoted to the use to which it was best and most economically fitted. I feel that if Blith's book were given the same treatment that has recently been accorded to the St. James Version of the Bible, in order that persons studying it could more readily and quickly comprehend its teachings, it would make a valuable addition to the text books used in the curricula of present day agricultural colleges and likewise a handy volume on the desk or in the pocket of soil technicians.

Blith was a great advocate of drainage and he insisted on deep ditches that were adequate for the purpose that they were intended to serve. He was an equally vigorous advocate of irrigation where required. He devoted whole chapters to soil treatment. He recommended the combined use of lime and organic fertilizers and he insisted that such treatment be given not only to poor land but to rich land to prevent its degeneration. He warned against over pasturing and advocated soil treatment to regenerate old pastures. In fact he recommended periodic liming and fertilizing of all pasture land. He advocated cutting of broomsage rather than burning.

Quoting him briefly on this: "The best means for that, is to cut it in the hottest and dryest time of summer, when the Sappe is drawne cleane forth of the Root, and many times this will destroy it." Blith further recommended liming and fertilizing as a follow up to the cutting although he preferred to plow this in and sow pasture grass seed to achieve quicker results.

Blith likewise was perhaps the first writer to specifically recommend the planting of what we know today as cover crops. He pointed out that land improvement was expensive and that there were no short cuts but that future results justified the expense. He was a strong supporter of reforestation and selective cutting, and recommended fencing livestock out of forest lands.

Blith fought a constant and unremitting war against communal husbandry and the use of common-fields. A good way to conclude the subject of Walter Blith is by quoting the following poem written by his friend "P. W." which follows the title page in the first edition of the "Improover":

"Go tell the World, of Wealth that's got with ease,
Of Certaine Profit (gaine most men doth please)
Of Land's Improvement to a Treeble worth,
A Five, a Ten-fold Plenty's here held forth;
The greedy Land-Lord may himselfe suffice;
The toyling Tenant to Estate may rise,
The poore may be enricht, England supply'd
For twice so many People to provide;
Though this a Paradox may seeme to you.
Experience and reason proves it true;
By floating Dry, and purging Boggy Land,
The Plough, old pasture betters to your hand;
Directions to Inclose, to all mens gaine,
Minerals found out, Land rich'd with little paine;
Woods ordered so, in few years yield such store,
So large, so good, as you'le desire no more.
In fine, all Land in each Capacity,
In which it lyes, made Pleasant to your eye."

Only in recent years have we developed specialized schools of thought on conservation. Hunters and anglers, banded into so-called "sportsmen's clubs," are chiefly concerned in problems adversely affecting their special interests, leaving the general conservation program to others.

This cleavage of the public interest has nurtured, rather than prevented, the very abuses sportsmen's groups have been fighting vigorously.

Now the pendulum is swinging toward the broader concept of conservation for all the people and clear thinking leaders are pointing the way to an unselfish approach to recreation, public health and welfare and the many other benefits of good conservation practices and programs.

When this enlightened concept is generally accepted, we will have returned to those broad conservation principles and practices of our forefathers, antedating the more immediate exploitation of our natural resources.

And this will be all to the good for everyone.

The Higgins Lake Conservation Conference

STANLEY A. CAIN

A UNIQUE CONSERVATION meeting was held on September 11-13, 1952, at Higgins Lake, Michigan. This conference of representatives of business, industry, and finance operating in Michigan met with such enthusiasm on the part of the participants that it is showing signs of losing its uniqueness.

In March, 1952, the Industrial Relations Committee of the Michigan Chapter of the Soil Conservation Society of America reported at the state meeting it wished to undertake a conservation conference for Michigan business men. A similar conference had been proposed by the National Association of Manufacturers' committee on conservation. The society extended its blessing and the committee held its first planning meeting in Howell, Michigan, April 4. From that time until the conference was held in mid-September, the committee met about every ten days.

The planning of the committee soon led it to depart in two respects from the NAM proposal. The original purpose was "to provide a freely accessible source of fundamental and impartial information concerning manufacturing's responsibilities in the field of conservation of the nation's renewable resources." The Michigan conference was to consider all resources, not just renewable ones. The second departure was even more important. The small group of industrialists who were to be assembled were not to be lectured to by professors, but were themselves to carry the ball.

It soon became apparent that the job of developing the conference was too large for the original SCSA committee, so it was expanded to become the General Committee with representatives coming from industry, resource conservation agencies and institutions.

From the beginning the committee felt that an appropriate program, appealing to the self-interest of business as well as to social obligations and opportunities in conservation, would be able to attract a number of top-level persons. The conference was conceived as a pilot project, to be kept small; and the faith of the committee was borne out by the fact that thirty-five such persons, representing twenty-seven companies, participated. The conference was held on an invitational basis with an effort on the part of the committee to obtain a wide representation of Michigan's varied interests. In addition to the thirty-five industrialists, there were six press representatives and an assisting staff of twenty.

The conference opened informally on Thursday evening, September 11, at the headquarters of the Michigan Conservation Training School on the wooded shores of Higgins Lake, a little over two hundred miles north of Detroit. The first session was concerned with "An Appraisal of the Natural Resource Situation in Mid-Twentieth Century." In the afternoon there was a field trip (led by Michigan Department of Conservation personnel) which demonstrated many different kinds of natural resource problems and some of the state and industrial solutions that have been found for them. The third session dealt with the "United States' Position in the International Resource Picture." The final session, on Saturday, tackled the question for which the conference was designed: What is "Industry's Stake in Conservation?"

About eighty different pieces of conservation literature, largely the product of industry, were on exhibit and most of them in sufficient quantity for pickup. A special subcommittee prepared a Source Book of background materials for conference participants.

This book, which contained nearly a hundred tables and charts gathered from various sources, presented recent, authoritative information on Michigan, United States, and world resources—supplies and demands. Because of the desire to save time for discussion, the Source Book was designed to allow speakers opportunity to

About eighty different pieces of conservation literature were on exhibit during the conference.

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Field trips demonstrated many different kinds of resource problems.

present ideas and deal with problems without having to build up supporting data.

Space does not permit a treatment of the content of the conference—the fine developments of their areas of responsibility by panel members and of contribution to the group thinking by general participants—but it can be said that there was a general consensus that the conference had been uniquely productive and provocative.

And the final test, of course, lies in the fact that the conference is not terminal, but initial. The enthusiasm engendered at Higgins Lake and the new visions of opportunity and responsibility—of enlightened self-interest—are not being dropped, but translated into further exploratory conferences and into industrial action programs.

The follow-up conference held at Haven Hill was smaller than the original conference, but all of the former attendants who could make it were present or represented by a company member. This meeting had no speeches or panels and addressed itself to the following questions: What is my company doing for conservation? Should there be a second general conservation conference for the purpose of reaching a larger number of leaders in business, industry and finance? Should we organize a Conservation Council composed of companies and corporations to facilitate their programs in resource use?

Specific decisions of the follow-up conference were two. The general committee that had organized the Higgins Lake Conference was asked to develop a second conference to be held early in 1953. A committee was authorized, with L. A. Danse, of General Motors, as chairman, to frame a plan for the organization of a Conservation Council, including a proposed constitution and by-laws, and that this committee should report back to the group at the next conference. It seems, then, that this group is not satisfied with discussion, but is going forward with a program of action and cooperation in a businesslike manner.

Agriculture is an Important Industry

One out of every six Americans are engaged in producing food. In 1916 one out of three were doing the same job. And a century ago, 75 per cent of the United States labor force was engaged in agricultural pursuits, compared with only 16 per cent today, USDA statistics show.

During recent years, America has become increasingly dependent upon fewer farmers for its food. Because of the many technical advances, America's farmers likewise are hopelessly dependent on steel, chemicals, oil, rubber, and power.

Farms in the United States during 1952 used 7,000,000 tons of finished steel, more than is used in a year's output of automobiles; 50,000,000 tons of chemical materials, five times the amount used in 1935; 16½ billion gallons of crude petroleum—more oil for power than is used by any other industry; 320,000,000 pounds of raw rubber—enough to put tires on 6,000,000 automobiles; and 15 billion kilowatt hours of electrical power—enough to supply Chicago, Detroit, Baltimore, and Houston for a year.

Population in the United States also increased last year by 7392 per day, thus requiring 112 more tons of food every week—enough additional food to fill an 83-car freight train every year. Food consumption per person is estimated at more than three-fourths of a ton annually. The average adult eats his weight in food every six to eight weeks.

Boy Scouts Apply Conservation Plan on Own Camp Area

JAMES E. McDONALD

A successful Conservation Camporee was staged by more than 300 Boy Scouts and their leaders in cooperation with representatives of the Charleston County, South Carolina, Soil Conservation District. This unique event, the first of its kind ever held, provided an excellent opportunity for scouts to see how a conservation program is developed and applied.

BOY SCOUTS who are eager for a full-scale conservation job might take a leaf from the book of the Coastal Carolina Council, at Charleston, South Carolina, and develop a conservation plan for their own camp area.

The Coastal Carolina Council, through their Scout Executive, J. Rucker Newberry, requested the Charleston County Soil Conservation District to make a conservation plan for Camp Ho-Non-Wah on Wadmalaw Island near Charleston. The Scouts soon found that developing and carrying out such a plan, based on a survey by a trained soil surveyor, is a truly scientific undertaking.

Pasture development, cropland drainage and improvement, reforestation, woodland management and fire protection, wildlife development, construction of a freshwater pond for fishing and boating, streambank erosion control, and road relocation were among the practices planned. Of course, they would need a lot of help in carrying out a plan like that. But the Scouts learned that there are a lot of people ready and willing to lend a helping hand for conservation.

The survey information was recorded on an aerial photographic map which they learned to color to show land capability. And then the land use map was made to serve as a guide for their conservation operations. By that time the development had become an intriguing enterprise. But the real fun was still to come in applying the plan.

Soil Scientist M. W. Sullivan, Kingstree, S. C., talks to scouts about soil and its properties. Sullivan is standing in one of three holes excavated to show scouts difference in soils on scout camps.

Assured of technical assistance in the forestry, wildlife, and soil conservation phases of the program, and promised the loan of equipment by local farm machinery dealers, the Council decided to hold a conservation Camporee on February 6 and 7 as the first step in putting some of the conservation measures into practice. More than 300 Scouts and their leaders assembled during the afternoon of February 6 for the over-night camp.

In front of a roaring fire that night in the mess hall, they prepared for the big event next day with stories and movies depicting the waste of natural resources in America. Conservation was stressed as the way to preserve and build up these precious resources. Story-telling time was concluded with the presentation to each Scout of a forest-green neckerchief bearing an emblem that portrayed soil, water, woodlands, and wildlife. The neckerchiefs were a gift from the supervisors of the Charleston County Soil Conservation District.

Some of the Scouts bunked in cabins, but many hit the sack on the cold, damp ground in tents. A few hardy ones who slept in the misty moonlight had their dreams of their new adventure rudely interrupted by the pelting rain of an early spring thunderstorm before dawn. But all were up bright and early with undampened spirits for the day's adventure.

The Scouts assembled in rotating groups of 50 to study soil profiles, determine land capability, plant pine trees, fertilize and seed pasture. They observed cropland management practices, planted wildlife bicolor food patches, and practiced woodland management.

For several weeks prior to the Camporee, interest had been built up at Scout Courts of Honor, Leaders' Round-

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This bicolor planting operation is under the direction of Paul W. Sturm, Manager Cape Romain National Wildlife Refuge, McClellandsville, S. C., U. S. Fish & Wildlife Service.

tables, and Troop meetings at which conservation movies were shown, conservation projects were outlined in talks and discussions, and conservation literature was distributed.

One of the big preliminary events was an essay contest sponsored by the Agricultural Society of South Carolina, of which Thomas Jefferson was once a member. Subject of the essay was, "Why A Farmer Needs A Land Capability Map." The prize was a gasoline lantern offered to the troop which turned in the winning essay.

Essays and colored capability maps of the camp were brought in on the day of the Camporee. Presentation of the lantern was made by John E. Jenkins, chairman of the board of supervisors of the district, at the midday meal, which was provided for the 300 Scouts and their leaders and guests by the Charleston Chamber of Commerce. The lantern was received by Donald Fortner, who wrote the winning essay on behalf of Troop 68 of North Charleston.

Down to Earth

To emphasize further the importance of land capability, pits had been dug in advance to show the profiles of three contrasting soils, varying in drainage characteristics from poorly drained to well drained. A soil scientist of the Soil Conservation Service at each pit explained the soil characteristics that influence land capability. Scouts got the "feel" of light-, medium-, and heavy-textured soil samples at each pit.

The soil scientist pointed out contrasting surface soil colors and explained in detail the subsoil changes in color due to drainage differences. After examining each soil profile, the Scouts checked on a simple form the surface and subsoil textures, color of surface soil, and the drainage of the subsoil. With the aid of another sheet, describing in tabular form the eight capability groups based on characteristics which the Scouts had observed, they then made capability determinations. Answers averaged 92 percent correct for the sheets turned in.

Green Pastures

Pasture development might at first seem to be an odd undertaking for Boy Scouts to engage in. But they had a reason. For years, neighboring farmers had been in the habit of burning off the camp's broom sedge fields to provide early spring grazing for their family milk cows, a practice that posed a serious threat to the pine seedlings to be planted. To discourage the practice of burning, provide a demonstration of the value of improved pasture, and do a Good Turn for their neighbors at the same time, it was decided to plant 2½ acres of improved pasture for the neighborhood farmers to use.

As a part of the advance preparation, Scout troops grubbed out bushes and roots, and several district cooperators donated their equipment. One farmer, Gunther Wallen, said that he got a greater thrill out of watching the Scouts doing conservation work than from his wartime job as a test pilot. His Scout son was one of the tractor operators. Many of the city born Scouts, watching a bulldozer knock over trees and push them out of the way like match sticks, decided then and there they wanted to be bulldozer operators.

Coastal Bermuda grass stolons were planted and fertilized in one operation, using the district owned planter. Scouts loaded the planted with stolons and fertilizer, a thousand pounds of which was provided by a Charleston firm. The pasture will need more attention during the growing season, which will give the Scouts additional experience in conservation farming.

Another farming operation was observed on four acres of camp land which is used by a neighboring farmer. He grows Irish potatoes, beans, and other truck crops. The land is wet and has a system of open ditches for drainage. County Agent C. W. Carraway demonstrated to the Scouts the importance of drainage, organic matter, fertilizer, and proper management for this land.

Timber-r-r!

Foresters of the South Carolina Commission of Forestry, who had charge of the tree planting, woodland management, and fire protection, did an excellent job of getting across the idea of forest conservation. A week prior to the Camporee, a crew of Scouts had notched scrub oaks on the site to be planted to pines. Ammate crystals were put into the notches to kill the trees. The

Explorer Scout Barney Beard showing scouts how to measure the diameter of a pine tree, before determining its volume in board feet.

dead trees will be cut down for firewood as needed. This represents good conservation and wood utilization, it was brought out, because wood lying on the ground decays very rapidly in warm climates.

Pine trees from the State Nursery were planted on three of the 34 acres planned for trees. A tree planter could have done the job in a short time, but there would have been no Scout participation. So all the trees were planted by a four-man crew, two planting, one bringing trees, and another keeping a straight planting line. Careful planting to insure survival was the order of the day. Speed demons were discouraged from showing their stuff. The foresters convinced the Scouts that they were big brothers to the little pine trees.

From planting a pine seedling to measuring board feet was a big jump, but the Scouts took it in stride. They measured diameters, estimated heights, and determined the number of sawlogs in trees with great enthusiasm. The foresters explained that certain scrub oaks should be cut because they were shading out more desirable trees. In a pine thicket, some trees were removed because they were defective and others because they were holding back the growth of better trees. Mature pines were marked to be cut for lumber, with other trees not suitable for lumber to be used for pulpwood. All of this, the Scouts learned, was a part of conservation and wise use of forest resources.

Food for Thought—and for Birds

Most boys like to take pot shots at birds with an air rifle. The Scouts were reminded by Paul Sturm of the U. S. Fish and Wildlife Service that all such actions are forbidden by state or federal law. He explained the role of birds and animals in the cycle of nature and conservation so effectively that many a Scout resolved never again to do any more target practicing on birds.

Fast-flying hawks—not those usually seen perched in a tree—are the ones that get the chickens, they learned. It also surprised them to hear that lack of food often kills more birds than hunters do. So the Scouts could readily understand the need for planting bicolor lespedeza plants, the seeds of which provide food for quail during the winter months. The Scouts went down the rows laid off for planting bicolor putting down white trails of fertilizer. As in tree planting, they paired off, one boy handling the dibble, the other putting in the plants. In all, 3,000 plants were set out in three of the ten strips planned for the camp area.

The Camporee launched the Coastal Carolina Council on an adventure in conservation that they hope to carry on for many years. It showed them that soil, water, woodland, and wildlife have many friends that are always ready to help them do a good turn for conservation.

Aids in Evaluating Sheet Erosion

(*Continued from page* 81)

The conditions described in classes 1, 2 and 3 are by far the most common in Northeastern United States. These are the three classes which, in effect, have been used in mapping sheet erosion in soil surveys (soil conservation surveys) in this part of the country. Classes 4 and 5 are recognized and mapped in some districts, but due to small extent, they are included with class 3 in many of the surveys.

In some cases, the identification of the erosion class is actually done about as follows: The surveyor can recognize areas with little or no erosion (Class 1) and he can identify the moderately severe or severe erosion conditions (Class 3 or worse). Everything else is mapped as Class 2.

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Book Reviews

THE FUTURE OF OUR NATURAL RESOURCES. STEPHEN RAUSHENBUSH, *Ed. The Annals of the American Academy of Political and Social Science. Vol. 281, pp. 1-202. Philadelphia, Pa. 1952.*

This symposium dignifies the subject of conservation by devoting an entire issue of the August "Annals" to an examination of its major aspects by 24 different authors. As might be expected from the nature of the Academy itself, the attention is directed to the philosophical rather than the technical aspects of the subject.

One seldom sees such a comprehensive survey under one cover. Both "renewable" and "nonrenewable" resources are discussed. The character of the treatment ment and the viewpoints expressed perhaps can best be indicated by enumerating the authors, for they are in each case about what we have learned to expect from the respective speakers. They are presented under four headings, as follows:

Mineral and Energy Resources—Alan M. Bateman, Howard A. Meyerhoff, George A. Lamb, Robert E. Hardwick, Eugene Ayres, and Paul J. Raver.

Forests—Samuel T. Dana, Daniel L. Goldy, T. D. Stevens, Dewey Anderson, and Hardy L. Shirley.

Soils—Richard Bradfield, Paul B. Sears, M. M. Kelso, and Charles M. Hardin.

Water Resources—Robert G. Snider, Morris E. Garnsey, Stephen Bergen, and Hugh H. Bennett.

As a background for all this, Stephen Raushenbush, Robert O. Beatty, and John R. Baker discuss "The Setting of Conservation." Anthony Wayne Smith reviews the subject from the standpoint of labor, and H. A. Young reports on the situation in Canada.

All in all, the prospects seem to appear rather glum to these authorities. There is much soul-searching and repeated attempts to define "Conservation." Although each has his own slant, the discussions revolve mainly around the idea of "use without abuse." Economic forces and governmental and social organization come in for a large share of attention.

This symposium commits to the record in one volume several widely divergent viewpoints, which, to this reviewer, failed to define any clear cut answer to the central question, "What of the future of our natural resources?"

—BEN OSBORN, *Midland, Texas*

USING COMMERCIAL FERTILIZERS. *By* DR. MALCOLM H. MCVICKAR. *208 pages, 106 illustrations, 1952. The Interstate Printers and Publishers, Danville. Illinois. $3.00.*

Dr. McVickar emphasizes conservation throughout this well illustrated new book which starts with a picture showing contour cultivation and terracing. As chief agronomist for the National Fertilizer Association, the author points up the loss of millions of acres of good soil through erosion. It would require, he writes, 50 million acres to produce present quantities of farm products without the use of fertilizer, also the cost of cultivating such an acreage would be more than three times the annual expenditures by farmers for fertilizer.

The author discusses the use of commercial fertilizers, pointing out that it is the most important means known to man that will provide an abundance of economically-produced food and fiber and at the same time conserve the soil.

Of particular importance to the conservationist is the section: "The Importance of Commercial Fertilizer in Building up and Maintaining Soil Organic Matter."

Dr. McVickar works closely with agricultural college staffs, Soil Conservation Service leaders and others in the conservation movement. His book is non-technical and contains much factual information.

—WARREN C. HUFF, *Columbus, Ohio*

UNDERSTANDING IOWA SOILS. *By* ROY W. SIMONSON, F. F. RIECKEN and GUY D. SMITH. *William C. Brown Company, Dubuque, Iowa. 139 pages. Illustrated. 1952. $3.00.*

This book describes the soils of Iowa and tells something about their origin. Separate chapters cover the general nature of soil, the factors responsible for soil formation, the ways in which soils are classified, and the nature and distribution of the soil regions in Iowa.

The authors' description of the glacial geology of Iowa is extremely interesting and is definitely helpful to the reader in understanding the nature of Iowa soils.

An outstanding and valuable feature of this book is a series of block diagrams illustrating the soil patterns as related to parent materials, topography, and vegetation. These diagrams, together with profile diagrams of the major soils, contribute greatly toward understanding the nature and properties of the soils in Iowa.

The chapter on soil formation gives a brief but clear explanation of the usual and generally recognized five soil-forming factors, which are: Climate, living organisms, topography, plant materials, and time. In a more complete discussion of soil formation, the authors might have included another important factor—*use of soil by man.* Surely the kinds of soil which many farmers work today are influenced by the way such soils have been managed. For example, a soil that has been severely eroded performs and behaves quite differently from one that still has its original surface soil. This is especially true in soils with a distinct contrast in the profile between the surface soil and subsoil. Other practices by man that often influence the formation and nature of soils are irrigation, drainage, and addition of large quantities of fertilizers and organic matter.

In the chapter on "Classification of Soils" some soil

scientists may take exception to the principle expressed that the loss of the A horizon does not change the soil type. Certainly a farmer, in many instances, would think he was farming two different soil types if one had lost the A horizon and another was uneroded.

More emphasis could have been given to the effect of slope and erosion conditions in the discussions on relating management practices to the different kinds of soil.

An appendix gives some laboratory data on the chemical and physical properties of several of the major soils in Iowa. It includes a useful bibliography on formation, classification, geography, use and management of soils. Uncommon words as well as words that have been given special meanings in soil science are defined in a glossary.

We should have more books similar to this one for other areas.

—R. D. HOCKENSMITH, *Washington, D. C.*

RESOURCE CONSERVATION: ECONOMICS AND POLICIES. *By* S. V. CIRIACY-WANTRUP. *University of California Press, Berkeley. 395 pages. 1952. $6.50. (A Spanish edition contains an additional section on Latin American conservation policy.)*

Despite the widespread interest in conservation, professional economists have devoted little attention to the social aspects of this important public issue. In their investigation of most conservation problems economists have generally relied heavily upon traditional market-price analysis, giving special emphasis to the time factor in the utilization of resources and the maximization of economic return. The work of S. V. Ciriacy-Wantrup, professor of agricultural economics at the University of California, is a notable exception to this practice. Ciriacy-Wantrup's numerous articles in the professional journals, now capped by the publication of *Resource Conservation,* represent an impressive contribution to both the private and social economics of conservation.

The organization of *Resource Conservation* follows the logical functional distinction between the private and social aspects of conservation and includes a critical survey of existing tools of social conservation policy. Throughout the study the author shows a keen appreciation of the importance of institutional influences and an unusually wide knowledge of the special characteristics of a variety of natural resource problems. On the whole, the broad conception of the study and the breadth of view of the analysis are among its most commendable features.

Well over half of the book is devoted to an analysis of the conservation practices of the private planning unit (such as the farm or firm), and chapters on interest, taxation, uncertainty, market form, economic instability, tenancy, and credit indicate the author's approach to this topic. Unfortunately much of this first section is marred by an excessive use of technical economic terminology. Some of the chapters in this section, such as those on market form and uncertainty, are likely to be discouragingly incomprehensible to the non-economist — whom the author announces he wishes to reach—without at the same time raising the rigorousness of the analysis to a point justifying such usage. The non-economist will be wise to follow the author's suggestion that certain of the chapters on private conservation can be skipped without serious loss. Indeed, if this advice is not followed, the book may be abandoned as a result of a mistaken early impression that it is essentially a sterile extension of formal economic analysis.

In considering the social objectives of conservation policy, however, Ciriacy-Wantrup carries his investigation well beyond the confines of market analysis. Extra-market values are appraised and the administrative valuation process is discussed; a concept of a "safe minimum standard" of conservation is developed at some length, although no attempt is made to specify in resource terms what this "minimum" actually is at the present time. A brief but cogent survey of tools of conservation policy, such as zoning, education, public management, and international agreements, together with a final chapter on administrative problems, complete the section on social conservation.

Because of the extremely wide scope of this undertaking, there are times when its main theme becomes somewhat concealed—especially during the early discussion of private conservation. But such shortcomings are of minor importance in comparison with the author's major accomplishment of synthesis of the principal economic aspects of conservation knowledge.

—L. G. HINES, *Hanover, New Hampshire*

FORESTS FOR THE FUTURE. THE CONSERVATION FOUNDATION, *30 East 40th Street, New York City. Published as a Supplement to American Forests Magazine, December, 1952.*

The Conservation Foundation has performed a real service for those who would attempt to interpret fairly the significant facts relating to our forest resources. With the many divergent groups that today are interested in the present forest situation, it becomes very important to recognize the wide variation in conclusions which grow out of the commonly accepted facts regarding our forest resources. The Conservation Foundation has endeavored to present the respective views of the U. S. Forest Service, of the wood manufacturing and processing industries, and of Dr. Luther Gulick in his recent study published for the Institute of Public Administration, entitled "American Forest Policy."

The fields of discussion in this study deal with

"Drain, Growth and Supply," "The Problem of Small Holdings" and "The Problem of Regulation of Private Practices." It can be noted at the offset, the very wide areas of agreement that exist on many of these issues between the views of the Forest Service and those of the forest industry. They include the following major factors:

1. Our present area of commercial forest lands has sufficient productive capacity to supply the nation's needs for wood, if the growth potential can be realized.
2. Protection from fire, insects, and disease as a prerequisite to the accomplishment of the first factor.
3. Reforestation of denuded and understocked lands where capable of profitable production.
4. Elimination of destructive cutting practices.
5. Adoption of good management practices on all classes of forest ownership. In the case of small holdings, this will necessitate further education.
6. Coordination of research in both wood growing and wood utilization.

Major divergence between the forest industry group and the Forest Service exists on only two major points: *The rate at which our forests are still deteriorating; and the desirability of using government regulation to achieve the goal of checking depletion and increasing productivity.* Throughout the major items of discussion, Dr. Gulick's views seem to be that of a middle course between the differences expressed by the Forest Service and by the forest industry group.

The study concludes on an optimistic note as follows: "*Increasing opportunity to make profits through good management will speed progress towards continuous production. This progress will be uneven and spasmodic, but if public and private interests continue to cooperate the nation's forest objectives are attainable.*"

—HARRY S. MOSEBROOK, *Washington, D. C.*

THE SAGE GROUSE IN WYOMING. *By* ROBERT L. PATTERSON. *Sage Books, Inc., Denver, Colorado. 1952. 341 pages. Illustrated. $5.00.*

Anyone interested in the land of the buffalo and the pronghorn will want to read this monograph on the sage grouse. In addition to writing the results of a three-year research project on the life history of this amazing bird the author has interpreted the effects of land use changes on the behavior and population trends of the sage chicken. In fact, this is the first comprehensive study of a distinctly western game bird. Thanks are given to the Wyoming Games and Fish Commission for sponsoring the study under the Federal Aid to Wildlife Restoration program.

Some phases of the study and its application were state wide although the areas of concentrated study were in the Upper Green River Basin and in the area near Jackson. The relation of the grouse to agriculture in areas under irrigation as well as open range was studied in the Eden Valley irrigation district and in the high plateau grazing lands of central western Wyoming. One of the strong points of the book is the attention given phiographic, soil and land phases of both life history and restoration and management. Those conservationists interested in land will find these parts of special appeal.

The book is divided into four major parts: 1, "The Sage Grouse and Its Environment"; 2, "The Natural History of Sage Grouse Populations"; 3, "Sage Grouse and Man"; and 4, "Restoration and Management."

The first part covers taxonomy, distribution, a historical account and present status. It describes, in addition, the physical and biological features of its environment—related specifically to "development of the sagebrush-sage grouse community." Such factors as water, disease and other hazards on its population are related to the bird and its influence on its environment.

Part two is essentially original material on new techniques of determining populations and complete life history material including behavior, tolerances and requirements. Even though this is the scientific meat of the book it is easy to read and understand. This part is of particular importance because it presents the results of more than three years of day and night, summer and winter observations. Growth, plumage changes, weights and measurements, anatomy and adaptions are here given in detail.

The third part covers three major relationships to man: 1, trapping and transplanting; 2, recent hunting seasons and success; and 3, grouse populations and land-utilization patterns.

Relying on his broad background on the history of the west, Dr. Patterson skillfully sketches the decline of sage grouse with the changes in land use. He does his best writing in this part of the book, undoubtedly because of his strong personal feelings on land use changes and especially the movement from a natural grazing economy with sage brush the important forage plant to an unnatural grass economy. This movement will have great influence on the wildlife of the region. He argues that it would be a sad mistake to use any land management methods that would prevent wildlife from being "one of the most important secondary uses of wild lands in Wyoming." In his discussion of this he presents significant effects of industrial development—especially in oil and coal, intensive agricultural development, giving special attention to the effects of irrigation programs on the future of sage grouse. In speaking of the livestock industry he states, ". . . *the sagebrush eradication program is being carried out in total ignorance of the tremendous value of browse plants to the welfare of*

livestock and wildlife. Any land use practice which has as its objective the permanent elimination of sagebrush and establishment of grasses in the Mountain West will ultimately reduce the collective carrying capacity of that range for livestock (particularly sheep), elk, mule deer, antelope, sage grouse, and many smaller game species." This part of the book ends with a thoughtful discussion of the effect of predatory control activities upon sage grouse and related land uses.

Part four — on restoration and management — sets forth briefly the Wyoming Game and Fish Commissions views on restoring the range for wildlife and a plan of management for sage grouse. The reviewer believes this to be the weakest part of the book. It is hoped that study and analysis of this important bird will be continued so that sound and detailed management plans can be put into practice.

In addition to the technical excellence and readability of *The Sage Grouse in Wyoming* the fine pictures by the author and the excellent sketches by Charles W. Schwartz make it a book that everyone interested in wildlife will want in his library. *I rate it as the best volume on wildlife published in 1952.*

—WARREN W. CHASE, *Ann Arbor, Michigan.*

THE GRASS CROP—ITS DEVELOPMENT, USE AND MAINTENANCE. *By* WILLIAM DAVIES. *E. & F. N. Spon, Ltd., 22 Henrietta St., London, England. 317 pages. 1952. 26s.*

Dr. Davies was Director of the Grassland Research Station located at Stratford-on-Avon, and is an eminent world authority on grassland agriculture. His style of writing is interesting. He makes frequent use of personal experience or knowledge that transmits his thought to the reader in a simple, yet forceful manner.

In his book Dr. Davies has dealt with the subject of grass in the very interesting way of picturing his audience in his mind as individuals and simply writing his book to such individuals. He has discussed grass in all its aspects, but has given particular reference to its value to livestock. He emphasizes that the ley, or the grass-legume portion of the rotation, is a biological entity. He also traces the ecological development of the grasslands of Britain from the primitive forests to the ultimate highly developed swards quite commonly found on their best farms. The ley is treated as the basis for rotation farming. He places emphasis on the point that grasslands are man-made and they are maintained as grasslands because of the influence of man and his domestic animals.

In a climate zone that is capable of supporting trees the natural climax vegetation is almost always trees. Therefore under such varied conditions neither soil formation nor climate have an over-ruling effect upon the potential grassland type which could be developed at any given location. The factors under direct human control thus play by far the most important part in determining the characteristics of a given grass field. He emphasizes that it is the combined influences of seed mixture, livestock management and fertilizer treatment that will determine the botanical makeup of a grass field. He shows that in general the treatment applied to any given piece of vegetation determines the characteristics and the composition of that vegetation. Man and his grazing animals are the major biotic factors in determining land use. Grasslands in a humid area may be considered therefore as the biotic climax because it is climax only insofar as the biotic factor, (man and his animals) controls the other factors.

Dr. Davies treats the individual factors that are necessary in the development of the grass crop in considerable detail. He emphasizes the value of legumes and grasses in rotation with arable, row crops and small grain, and their relationship to the production of livestock. The value of various portions of grass-legume seed mixtures are treated very thoroughly. The use of herbs or weeds as indicator plants in mixtures, and also as valuable addition to the forage is emphasized.

A chapter is devoted to the wise use of marginal and hill lands of Britain which in many respects are comparable to the wooded hill lands of the United States. He draws attention to the food requirements of Great Britain and philosophizes and speculates from a technical point of view on the possibilities of rehabilitating the hill lands. His analogy of such lands would be of interest to many people concerned with similar lands, particularly in the eastern portion of the United States.

Having had the pleasure of meeting Dr. Davies and going over his station at Stratford, it is easy for me to understand his viewpoint of British agriculture that has done so much toward developing a grassland concept throughout the world. His constant emphasis upon the biotic factors in terms of both humans and domestic animals as the most important factors in determining the wise use of land and the quantity of forage or cover, is basic to his philosophy of grassland farming. His emphasis upon the wise use of land and the conservation of soil as a necessity for an abundance of food supplies, places him in the category of a true conservationist.

I would recommend the book to any agronomist who would view his own problems in agriculture, particularly grassland agriculture, from the vantage point of a very old country that has progressed through many stages of and use to their present one of stressing great importance on the grass-legume or ley portion of the rotation. The

animal, the ley and the arable crop all must go together in the closest possible association.

Dr. Davies, being a research specialist in grassland agriculture, naturally is conscious of the need for more research in the utilization of soil, grass and livestock. He approaches the research needs more from the applied side, showing the value of the experiences which he had in managing a grassland research station and the practical problems of reclamation during the critical war years.

His observations concerning the increased interdependence of the farmer and the research and the operations technicians indicate the present day attitude of the farmer for his technical advisors as compared to that of years ago. This close relation between the farmer and the various technicians will undobtedly become more important as competition throughout the world come to play a greater part, not only in agricultural production and marketing, but the well being of the Nation as a whole. Dr. Davies not only has included in his book a wealth of technical information, but has reviewed much of the history of English farming as well as giving a look into the future.

The book is interestingly written and is well worth reading and studying.

—GROVER F. BROWN, *Washington, D. C.*

NEW SOIL CONSERVATION SOCIETY FORMED IN INDIA

JOURNAL OF SOIL AND WATER CONSERVATION SOCIETY IN INDIA. *Published quarterly by the Soil Conservation Society of India. Vol 1, No. 1, October 1952. 58 pages + six. Hazaribagh, India.*

Volume 1, Number 1 is always a fascinating designation. It shows courage and faith—courage to undertake something new; faith in the venture that it represents. In this case it stands not only for a new publication, but a new organization. The Soil Conservation Society of India was born at a three-day symposium on Soil and Water Conservation (the first of its kind in India) held under the auspices of the Damodar Valley Corporation at Hazaribagh in December, 1951. The symposium was attended by soil conservationists from all parts of India, and by representatives of FAO and UNESCO.

Comparison of the new SCSI with the still young SCSA is inevitable. Their Council has somewhat broader power than ours—it approves membership, recommends Honorary Members, and places before General Meetings revisions of their "Rules of the Soil Conservation Society of India," corresponding to our Constitution and By-Laws. In most respects the SCSI seems less conventional than the SCSA. For example, there are only four classes of members: Patrons, Honorary members, Members, and Associates, who are students. In an editorial of their JOURNAL it is stated that ". . . any person or institution interested in soil and water conservation and the promotion of the objects of the society and agreeing to abide by the rules of the society is eligible to be a member. And this journal is for the use of all such people. . . . The wider the base, the less the possibility of the 'movement' taking a bias in one direction to the detriment of the others. . . . There is a hard core of soil conservationists at the back of the society who will go through with it." And there is the nub of the membership question!

As part of their objective the new Society quotes the Indian Planning Commission to the effect that "*it is in the national interest to insure that all land is properly utilized according to the best use that it can be put to. The best use of land may be broadly defined as that use under which land produces most and deteriorates least.*" The aims of the SCSI also include promotion of a survey of existing natural resources, such as types of land, water availability, and population distribution. The Society stands for 'an integrated approach by all government on these problems, spread of knowledge of sound soil and water conservation practices, and appreciation of soil and water conservation . . . with special reference to integrated development schemes of river valleys." Membership is five rupees ($1.05) per year, except for associates, who pay three rupees. There is now a membership of about 150.

The JOURNAL OF SOIL AND WATER CONSERVATION IN INDIA is a very neat and creditable publication, in spite of the fact that the Society claims "it has been got up by a few who have little knowledge of journalism, of printing and publishing, and have, besides, a very full day's work to do." It is on good paper, well stitched, 7¼x9¾ inches in size, and has a cover with green ink on heavy buff stock. A Society emblem appears on the back cover. There are six pages of ads, mostly for heavy equipment, and one full-page half tone showing those who attended the Hazaribagh meeting. There are Book Review and Correspondence sections. One of the publications reviewed is the SCSA booklet *Down the River*, with the comment that "such booklets should also be published and widely circulated in this country."

The Soil Conservation Society of America herewith congratulates the Soil Conservation Society of India on the appearance of its new JOURNAL, Volume 1, Number 1, and wishes it every success in moving toward the goal it has set for itself.

—EDWARD H. GRAHAM, *Falls Church, Virginia*

Field Notes and Comments

Conservationist Perfects Two Devices to Speed Up Field Work

The ingenuity of Biffle M. Morris, conservation aid for the Soil Conservation Service at Estancia, New Mexico, is enabling him and his co-workers to save a lot of time as they assist cooperators of the East Torrance and Edgewood Soil Conservation Districts with their conservation programs.

Morris has perfected two devices. One is an attachment for a motor vehicle to provide for more accurate linear measurements than can be obtained from speedometer readings. This device determines the length of terraces, field dimensions, and similar linear measurements. The other device is used in efficiently and quickly measuring the cross sections of terraces.

The linear measuring device includes an electrically actuated counter which is mounted on the dashboard of the vehicle to record the revolutions of one of the front wheels. Factors are determined for varying soil conditions through a series of trials. Then the number of wheel revolutions multiplied by the appropriate factor accurately determines the linear distance covered.

To provide for counting the wheel revolutions, a brass plate ¼″ x 1″ x 6″ is spot-welded to the left front wheel brake drum of the vehicle. A trigger is bolted to the steel plate which forms the inner side of the wheel assembly. This trigger contacts the brass plate welded to the brake drum each time a complete revolution of the wheel is made. This trigger must be insulated from the steel plate to which it is attached.

An insulated copper wire attached to the trigger runs to a coil which actuates the counter bolted to the dashboard of the vehicle. From the other terminal of the coil a wire is run to the vehicle voltage regulator.

Morris displayed his ingenuity in gathering the materials for the device. The trigger used on the wheel is an ordinary "dime store" cupboard latch. This can be fastened back so no contact is made when the vehicle is not being used for measuring. The coil and counter assembly were salvaged from an old pinball machine.

Morris has found that, through the use of this device, he can measure considerably more distances in a day than can two men using a chain, which is the customary method.

Determining Cross-section of Terraces

The device used for determining the cross-section of terraces consists of two metal stakes or posts to which brackets are attached so that a pull can be exerted from the top without pulling the stakes over when they are driven in the ground.

If a terrace is supposed to be 18 inches high, the stakes are set on each side of the structure so their tops are 18 inches high. A metallic tape then is attached to one of the stakes and stretched across the terrace and fastened to the top of the stake on the other side. If, when the tape is drawn taut, it is touching the terrace top, then the structure is of sufficient height. On the other hand, if the tape does not touch the terrace top, then the structure needs to be built up. Similarly, if there is excess dirt, the tape will extend upward from each stake to the

Figure 2.—*Left*—This shows the equipment used in measuring the cross-section of a terrace. The stakes are stuck in the ground on each side of the terrace and are braced by the triangle attachment. A metallic tape then is hooked to the top of each stake and the height of the terrace is readily determined.

Figure 1.—The tire of the left front wheel of the vehicle has been removed to give a view of the mechanism used to record revolutions of the wheel in measuring linear distances. A brass plate has been welded to the brake drum and a trigger has been bolted to the inner side of the wheel assembly. An insulated wire runs from the trigger to the coil which actuates the counter fastened to the dashboard. Each complete revolution of the wheel is registered on the counter and the distances are determined.

top of the terrace.

The base width of the terrace is obtained by determining the two points along the tape where the earth is 18 inches below the tape. Whether the terrace has proper slopes can be determined by measurements from the mid-points of the terrace slopes to the metallic tape.

These measurements can be made by one man in from five to ten minutes, whereas the customary method of measuring requires two men with an instrument and rod and takes from 15 to 20 minutes.

As an example of the savings in man-hours made possible by these devices, Morris made a 100-mile round-trip, measured and determined the cross-sectional area of 5.15 miles of terraces, and measured 118 acres of contour furrows on very rough range land in only seven hours.

Bankers Take to the Road

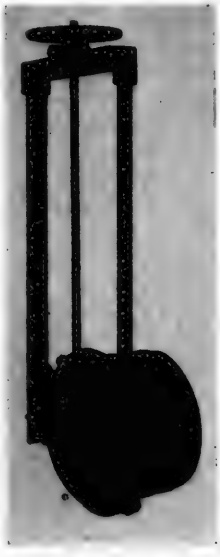
Connecticut bankers, who have been doing more and more to finance the conservation work of their clients and the public generally, "took to the road" in mid-September. Six hundred miles were covered to observe farms and farm practices in New Hampshire, Vermont and Massachusetts. The sponsor was the Connecticut Bankers Association's forestry committee working with the University of Connecticut. Those making the tour agreed it was a profitable "pioneering venture" and felt other organizations would benefit from similar observations "of the region's problems."

Committee for Conservation Now

The Maryland chapter, Friends of the Land, is distributing an attractive letter-size folder, *"Getting Under Way,"* in which the accomplishments of the first six months of the "Committee for Conservation Now," are reviewed in text and pictures. The program has two specific objectives: First, to influence farmers to apply good soil management, and second, to develop public interest in conservation. Farmers must be persuaded, the folder comments, that conservation is both practical and profitable and is directly related to the public's self-interest.

Resource Conservation on Public Lands

"Our Public Lands," a quarterly journal published by the Bureau of Land Management, U. S. Department of the Interior, is now in its third year. Carlos Whiting, the editor, says the publication is "a forum for the exchange of ideas and information on the development,



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utilization and conservation of the resources on public lands." The format is attractive, some color is used and many well-selected pictures appear with the text. A Question and Answer corner is one of the regular features. Another is a back page cartoon feature "It's the Land Law."

Individuals actively engaged in conservation work and officials in land management agencies may obtain this publication without cost by writing to the Bureau of Land Management. Other interested individuals should send their subscriptions (60 cents a year in the United States and possessions and 75 cents a year foreign) directly to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

Second National Land Judging Contest

The Second National Land Judging Contest, the newest of all judging contests, will be held at Oklahoma City, April 30 and May 1.

A training school on soils is scheduled for the first day, while the second day, May 1, will be devoted to the contest.

Each county is limited to one 4-H team, one FFA team, and four adults. The regular teams are limited to four individuals. In the adult division, the four compete as individuals and not as a team. A collegiate division is offered also. Each group competes separately for cash, gold watches and merchandise prizes.

Land judging schools and contests are competitive training events similar to livestock judging work. Instead of using a class of farm animals, fields are used in land judging work.

The perfect score on a field is 60 points. Four fields are used in the training school, making a total of 240 points. Approximately thirty minutes time is allotted to each field for the contestants' decision.

For more details, write Edd Roberts, Extension Soil Conservationist, Oklahoma A. and M. College, Stillwater, Oklahoma.

Conservation Program Sponsored by Goodyear Now Nationwide

The Goodyear Tire & Rubber Company will conduct a nationwide soil conservation awards program, starting July 1, 1953, to inspire voluntary soil conservation district workers, farmers and ranchers to even greater efforts to preserve the nation's topsoil.

Goodyear has sponsored a soil conservation awards program on a regional basis in 17 states for the past six years. The new program will be patterned after the old with 100 persons from all 48 states eligible for grand award vacation trips to the Wigwam Inn, on Goodyear Farms at Litchfield Park, Arizona, in December 1954.

All organized soil conservation districts in the U. S. are eligible to compete for the Goodyear awards. One member of each winning district and the top cooperating farmer or rancher named by the district will make the vacation trip to Arizona.

Non-partisan judging committees, selected from outstanding exponents of soil conservation in the various states, will select winning districts on a point system of rating actual accomplishment.

Winners will be announced at the seven regular regional meetings of the National Association of Soil Conservation districts. Plaques will be awarded at these conventions to the first and second place winners from the competing units.

Actual competition will be over a ten-month period with two months for judging. State soil conservation districts will compete with each other for first and second place awards with the following exceptions:

Vermont and New Hampshire will compete as one unit. Connecticut, Rhode Island and Massachusetts will make up one competing unit. Delaware and New Jersey

In Support of Soil Security...
NITRAGIN RESEARCH

The vigor and constancy with which the NITRAGIN Company promotes the value of legumes, and the importance of their inoculation, does much to further soil conservation and better farming practice. The NITRAGIN laboratories are the largest and most complete in America devoted exclusively to the production and testing of legume bacteria. If you have an inoculation problem or are conducting experiments that require special bacterial strains, write us about your work. We will be pleased to cooperate with you.

THE NITRAGIN CO., INC.
3281 W. Custer Ave., Milwaukee 9, Wisc.

Official S.C.S.A. Emblems

All members are eligible to own these emblems

¾ size

RING
10K Gold . . $23.00
Silver $12.00

BELT BUCKLE
Silver . . . $12.00
Bronze . . $ 6.00
including engraved initials

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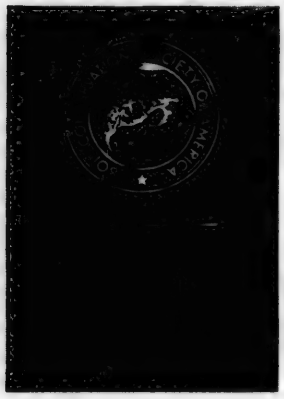


AWARD PLAQUE
4 inch SCSA emblem on 7 x 10 inch walnut
. . . $10.00
Engraving 7c per letter extra

TIE CLASP
Gold Filled
$5.00

½ actual size

Soil Conservation Society of America
1016 Paramount Bldg
Des Moines, Iowa

Prices include 20% excise tax

districts will compete together for the grand award.

The soil conservation districts of Texas will be divided into three competing units and the soil conservation districts of Illinois, Iowa, Kansas and Nebraska will be split into two competing units each.

Certificates of meritorious achievement will be given to 1,000 outstanding supervisors and cooperators after the close of the contest year on April 30, 1954.

Members of the advisory committee for the new nation-wide Goodyear Soil Conservation Awards program are: Dr. Robert M. Salter, chief of Soil Conservation Service, Chairman; C. M. Ferguson, director of extension, Department of Agriculture; Waters S. Davis, Jr., president of National Association of Soil Conservation Districts; Wendell R. Tascher, extension soil conservationist, Department of Agriculture; and H. Wayne Pritchard, executive secretary, Soil Conservation Society of America.

NEW WATERSHED FILM

Valley of Still Waters. *Sponsored by the Salt-Wahoo Watershed Association. Written and directed by* JOHN FREEMAN, *University of Nebraska, Lincoln, Neb. 22-minute color-sound. 35mm. 1953.*

This 22-minute color-sound educational movie, sponsored by the Salt-Wahoo Watershed Association of Lincoln, Nebraska, outlines the steps necessary for a complete watershed development program on agricultural lands in that area. It emphasizes structures and practices for erosion control, water conservation, flood abatement, and recreation and wildlife. The movie also explains the need for urban and industrial cooperation in a program based on agricultural development but of benefit to the entire watershed community.

"Valley of Still Waters" was produced by a $3,500 grant from Nebraska's Cooper Foundation and made in collaboration with the Nebraska College of Agriculture and the United States Soil Conservation Service.

Bromfield Receives Audubon Medal

Award of the Audubon Medal for distinguished service in the conservation of natural resources to Louis Bromfield was made at the annual dinner of the National Audubon Society in New York by Ludlow Griscom, chairman of the board.

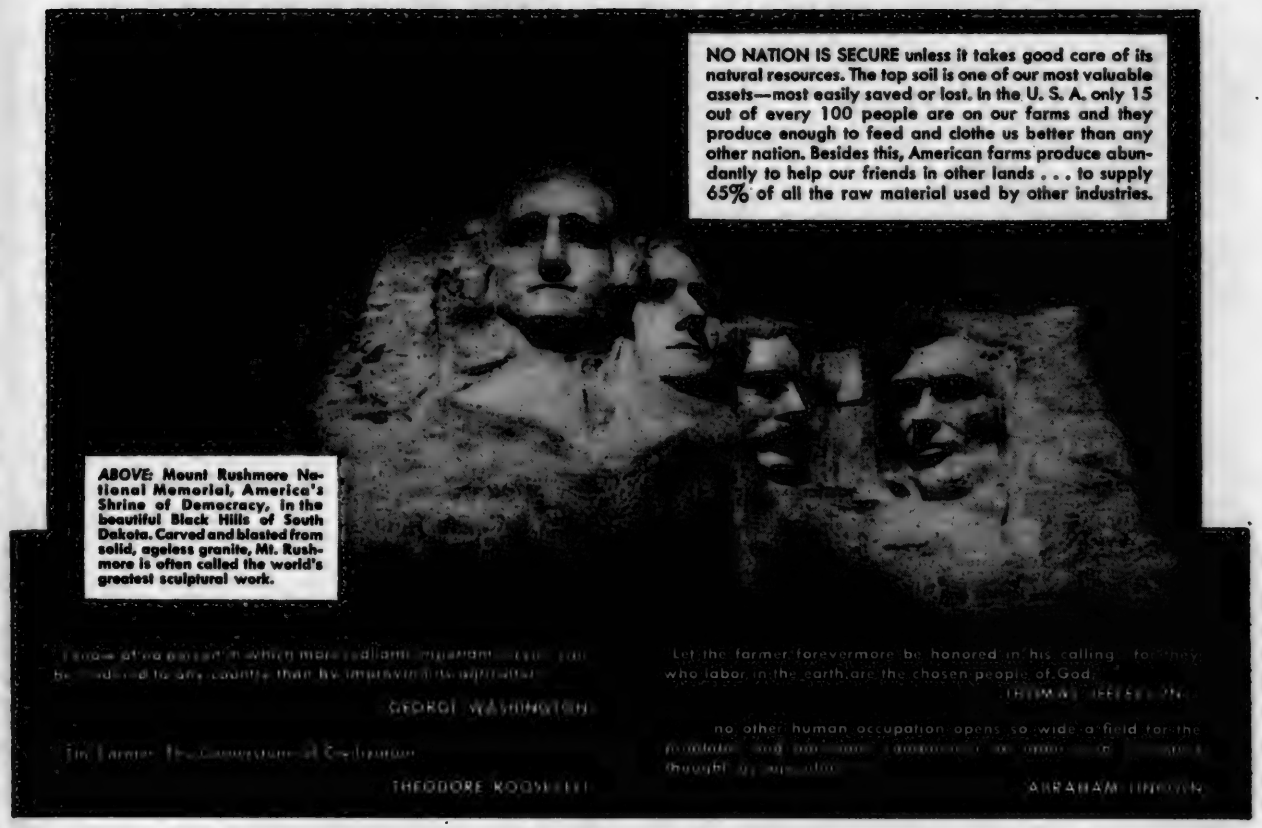
The citation states that at his Malabar Farm in Ohio, Mr. Bromfield "has demonstrated a pattern for man's living in harmony with nature on a sound ecological basis." Mr. Griscom made special reference to Mr. Bromfield's work in behalf of soil conservation and stated that his writings and lectures have "influenced the thinking of millions of people".

Upon recommendation of a special committee headed by Wheeler McMillen, editor of *Farm Journal*, the board of directors of the National Audubon Society unanimously voted to award the Audubon Medal to Mr. Bromfield. It has been given only three times before. Those previously honored were Hugh H. Bennett, former chief of the Soil Conservation Service; Ira N. Gabrielson, prominent wildlife conservationist, and John D. Rockefeller, Jr., whose part in developing the National Park system was cited.

Mr. Bromfield concluded his response after receiving the award with this statement: *"Instead of a wasted and ruined countryside, crossed by polluted streams, devoid of wildlife or beauty, it is possible to make of the whole nation a vast and wonderful park in the midst of which lives and works man himself surrounded by a kind of natural paradise. All this is far less of a dream than it might appear. It is merely common sense. More than that it is a plan that is profitable, not only in terms of dollars and cents but in a thousand other ways."*

There are two guiding principles which appear to operate with considerable force amongst Americans who are engaged in the various forms of conservation educa-

These four Farmer-Statesmen found the "Roots of Freedom" in the soil!



NO NATION IS SECURE unless it takes good care of its natural resources. The top soil is one of our most valuable assets—most easily saved or lost. In the U. S. A. only 15 out of every 100 people are on our farms and they produce enough to feed and clothe us better than any other nation. Besides this, American farms produce abundantly to help our friends in other lands . . . to supply 65% of all the raw material used by other industries.

ABOVE: **Mount Rushmore National Memorial, America's Shrine of Democracy, in the beautiful Black Hills of South Dakota. Carved and blasted from solid, ageless granite, Mt. Rushmore is often called the world's greatest sculptural work.**

I know of no pursuit in which more radiant immediate returns can be realized to the country than by improving its agriculture.

GEORGE WASHINGTON

The Farmer: The Conservation Conservation

THEODORE ROOSEVELT

Let the farmer forevermore be honored in his calling for they who labor in the earth are the chosen people of God.

THOMAS JEFFERSON

no other human occupation opens so wide a field for the profitable and agreeable exercise of the moral powers of mankind

ABRAHAM LINCOLN

You can help preserve that freedom through sound soil conservation

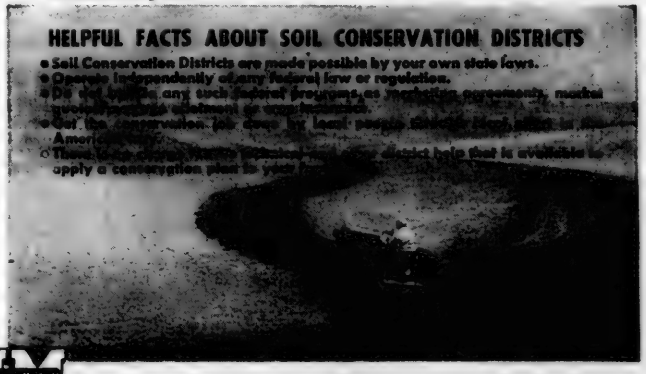
Your freedom . . . America's freedom . . . is rooted in the topsoil!

Washington knew this when he spoke out for soil conservation. Jefferson, Roosevelt and Lincoln knew it when they spoke for agriculture. Because they were farmers themselves, all four knew that hunger and poverty breed war and strife . . . that food and the products of the farm are powerful weapons for peace and freedom. They knew, too, that America's agriculture and the enterprising American farmer were, and are, keys to American greatness . . . that the industry of the soil was, after all, the basic industry of any nation.

Today, those things . . . the peace and freedom that hinge on farm production . . . are in the hands of you, the American farmer. *That* is why *soil conservation* is important both to you and to America.

Year after year more of America's future washes away—needlessly. Is anything being done about it? Yes, thousands of modern farmers like yourself are seeing the need for sound conservation practices and *are* attacking the problem. Typical are the farmers who have organized and manage 2300 non-political Soil Conservation Districts. Sure, it has cost them some money as an original investment. But ask a soil conservation man and he'll tell you that his land pays him many times over what he puts into it. Increased production pays back the principal plus increased yields. Then too, the generations of the future who will continue to live by the land, will benefit as even you do.

If you are interested in the program of Soil Conservation Districts, see your MM dealer today or write to the United States Department of Agriculture, Washington, D. C. Ask for complete information on establishing a soil conservation district in your neighborhood. You too, will find that the "Roots of Freedom" are in the topsoil . . . and they will be stronger because of you.

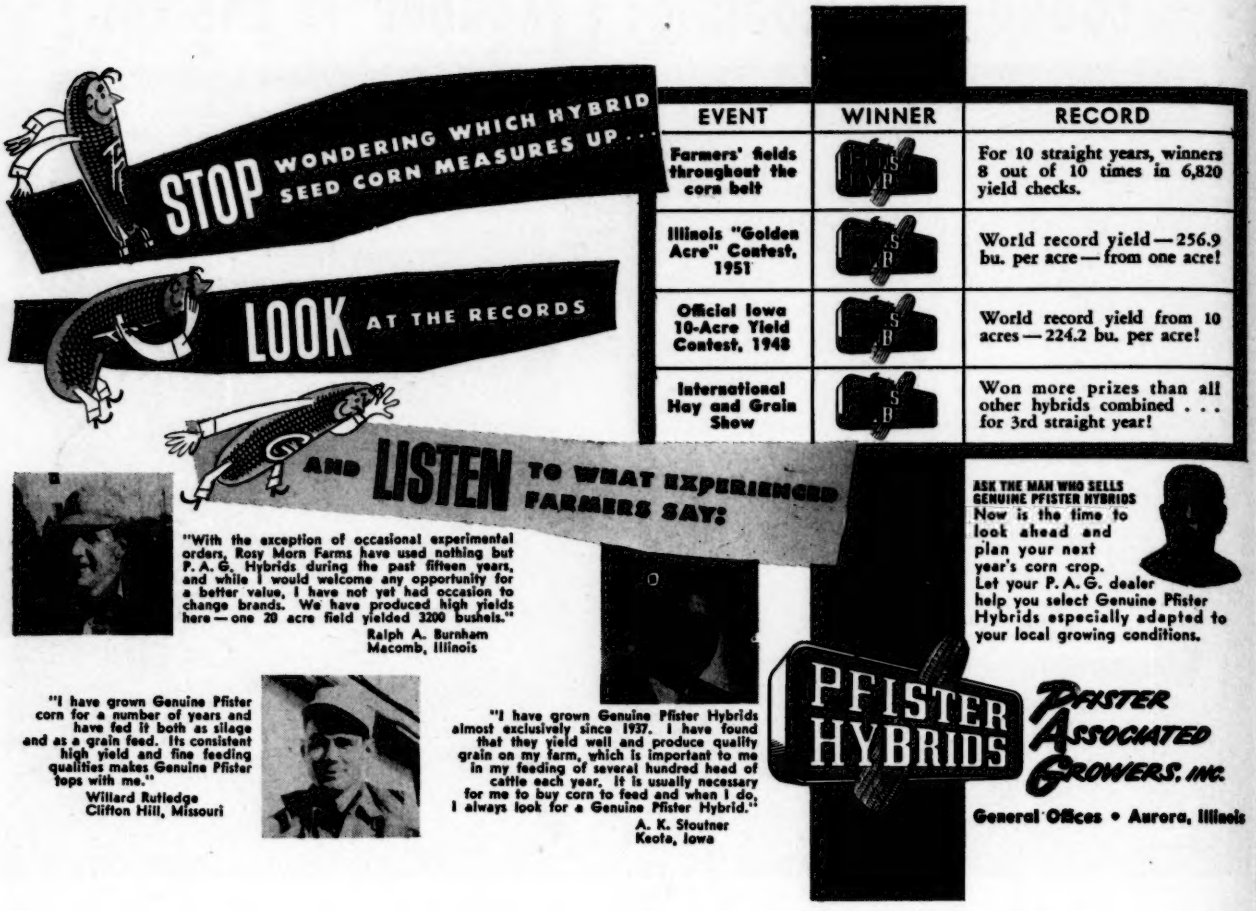

HELPFUL FACTS ABOUT SOIL CONSERVATION DISTRICTS
• Soil Conservation Districts are made possible by your own state laws.
• Operate independently of any federal law or regulation.

MM MODERN MACHINERY

MINNEAPOLIS-MOLINE

MINNEAPOLIS 1, MINNESOTA

MANUFACTURERS OF THE COMPLETE LINE OF MODERN VISIONLINED TRACTORS, FARM MACHINERY AND POWER UNITS FOR AGRICULTURE


STOP WONDERING WHICH HYBRID SEED CORN MEASURES UP . . .
LOOK AT THE RECORDS
AND LISTEN TO WHAT EXPERIENCED FARMERS SAY:
EVENT
WINNER
RECORD
Farmers' fields throughout the corn belt
For 10 straight years, winners 8 out of 10 times in 6,820 yield checks.
Illinois "Golden Acre" Contest, 1951
World record yield — 256.9 bu. per acre — from one acre!
Official Iowa 10-Acre Yield Contest, 1948
World record yield from 10 acres — 224.2 bu. per acre!
International Hay and Grain Show
Won more prizes than all other hybrids combined . . . for 3rd straight year!
"With the exception of occasional experimental orders, Rosy Morn Farms have used nothing but P. A. G. Hybrids during the past fifteen years, and while I would welcome any opportunity for a better value, I have not yet had occasion to change brands. We have produced high yields here — one 20 acre field yielded 3200 bushels."
Ralph A. Burnham
Macomb, Illinois
"I have grown Genuine Pfister corn for a number of years and have fed it both as silage and as a grain feed. Its consistent high yield and fine feeding qualities makes Genuine Pfister tops with me."
Willard Rutledge
Clifton Hill, Missouri
"I have grown Genuine Pfister Hybrids almost exclusively since 1937. I have found that they yield well and produce quality grain on my farm, which is important to me in my feeding of several hundred head of cattle each year. It is usually necessary for me to buy corn to feed and when I do, I always look for a Genuine Pfister Hybrid."
A. K. Stoutner
Keota, Iowa
ASK THE MAN WHO SELLS GENUINE PFISTER HYBRIDS
Now is the time to look ahead and plan your next year's corn crop. Let your P. A. G. dealer help you select Genuine Pfister Hybrids especially adapted to your local growing conditions.
PFISTER HYBRIDS
PFISTER ASSOCIATED GROWERS, INC.
General Offices • Aurora, Illinois

tion; and since they appear quite often in what follows it may be well to refer to them before proceeding. *The first is their fundamental belief in the need for an educational approach, combined with an equally strong belief in its efficacy.* This belief is to be seen at work throughout the Soil Conservation Service, though naturally it finds particular expression in the importance which they attach to their educational division.

The second principle, which is of course partly derived from the first, can also be observed at work in many aspects of their campaign. *They have found by the hard road of experience that more effective work can be done, at less expenditure of time, energy and money, by working with and through any group or organization which is already in existence and which is directly concerned with the matter in hand.*

National Forest Congress Called

Conservationists from all over America will convene in Washington, D. C., on October 29, 30 and 31 to re-examine all aspects of forest management and protection on public and private lands in the United States.

Called by The American Forestry Association, this American Forest Congress — the fourth in the 77-year history of the Association—will be in the nature of a national "town meeting" conducted on democratic principles of free and open discussion, according to Don P. Johnston, president of the AFA.

The main objectives of the October Congress will be:

(1) To bring the American public up to date on the current situation in respect to the proper management and protection of public and private forest resources in the nation.

(2) To bring together representatives of government, industry, agriculture, labor and the public for joint consideration of the forest situation.

(3) To consider such revisions of AFA's platform for American forestry as the Higgins Lake Committee may recommend.

When Does 1=4?

NEW CASE EDUCATIONAL MOVIE

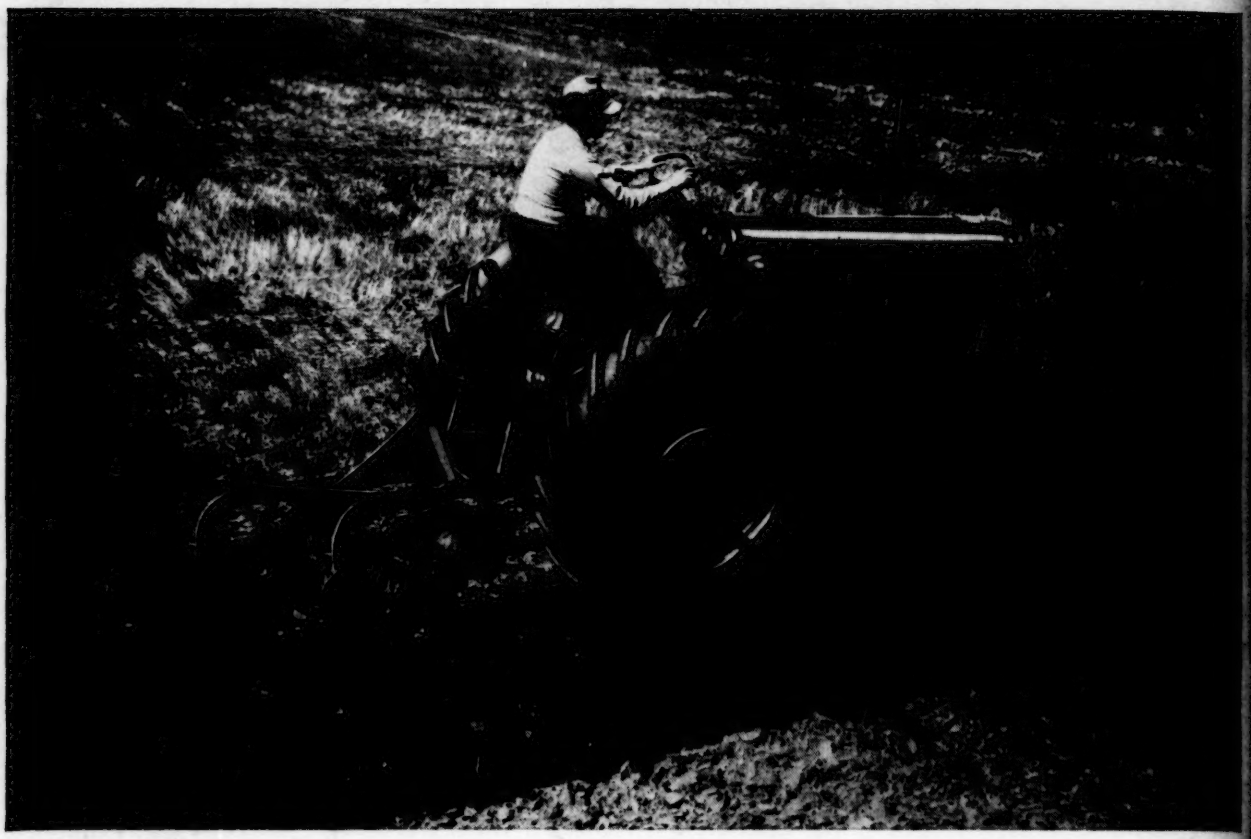
Shows You!

Here is a four-way teaching impact! New movie with companion poster, study guide, and take-home booklet tell farmers and farm youth how to make *one* acre of renovated pasture pour out all the meat, milk, wool, and cash that four unimproved acres now produce. This new quartet of Case educational materials shows how to test and treat soils—renovate old sod—establish rich new growth—how to use for immediate and long-time high income. The movie is entitled "One Equals Four," and like all Case educational movies is 16 mm., in full color and sound. Non-commercial; runs 22 minutes. Film is loaned, printed matter furnished without charge to teachers, agricultural leaders, farm and civic clubs, other responsible persons and groups. Film loans should be requested as far ahead as possible, and alternate date specified if feasible.

60 EDUCATIONAL HELPS

As its contribution to a prosperous, enduring agriculture, the Case Company has prepared some sixty educational items all free to users. These include motion pictures, sound slide films, posters, study guides, booklets, and charts on a long list of subjects on conservation and other profitable farming practices. Be sure you have the latest Case visual education materials catalog, "Visual Aids to Modern Farming." It describes each item and tells how to order. Be sure to get your catalog and all materials through your nearest Case dealer or branch house. J. I. Case Co., Racine, Wis.

CASE



Saves . . . On Every Round!

The perfect combination for a good practice is the nimble Oliver "66" and the compact, handy 3-point hitch moldboard plow.

A "floating" plow linkage permits you to follow contours with very little variation in furrow width as you change direction. You do a better job of plowing...and save time, besides.

Plowing depth is controlled with the fingertip "Hydra-Lift" system. You can make short turns at the headlands, maneuver in tight spots and back into fence corners with ease. And, the No. 1214 Plow raises high—and fast—for passing over grassed waterways and turning at furrow ends.

An Oliver "66" is your best 2-plow tractor choice, too. You have six forward speeds to fit any job...smooth, safe double-disc brakes that last longer...grouped controls and a comfortable rubber spring seat.

See your Oliver dealer, and see how much money Oliver's famous Raydex plowshares save ...how much time and effort an Oliver "66" saves. The OLIVER Corporation, 400 West Madison Street, Chicago 6, Illinois.

OLIVER

"FINEST IN FARM MACHINERY"